PAGE'S WEEKLY.—May 19, 1905. Thin Paper Copy for Circulation Abroad.

NO. 36. VOL. 6. SIXPENCE. (REGISTERED AS A NEWSPAPER.) FRIDAY, MAY 19, 1905.

PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

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PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY

Miscellaneous

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BOILERS

Wrot Welded Iron and Cast Iron Sectional

VERTICAL STEAM BOILERS

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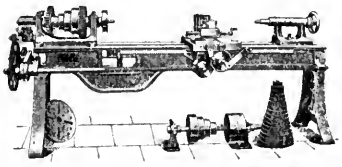

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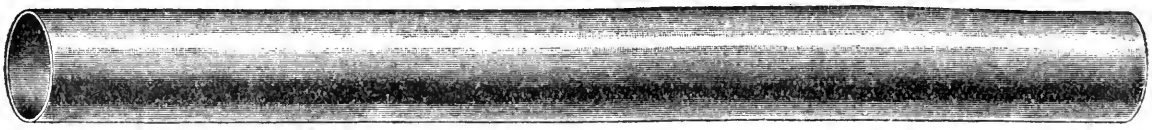

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For further particulars . . of our . . see our whole page Ad. on June 9th.

TIME RECORDERS

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PAGE'S WEEKLY — Miscellaneous

CONTRACTS.

REFUSE DESTRUCTOR AND FLAG-MAKING PLANT.

MUNICIPAL COUNCIL OF THE CITY OF SYDNEY, NEW SOUTH WALES.

The Municipal Council of the City of Sydney, New South Wales, invite TENDERS for the SUPPLY and ERECTION of SIX-CELL REFUSE DESTRUCTOR and for a FLAG-MAKING PLANT at Moore Park, within the City of Sydney, New South Wales.

Conditions of Contract, Specifications, and Tender Forms may be obtained on application to the Acting Agent-General for the State of New South Wales, Victoria Street, Westminster, S.W.

Tenders will be received up to Tuesday, May 30th, 1905, addressed to the Town Clerk, Town Hall, Sydney, New South Wales, endorsed "Tenders for Destructor and Flag Plant."

THOMAS H. NESBITT,
Town Clerk.

Town Clerk's Room, Town Hall, Sydney,
February 9th, 1905.

BRISTOL DOCKS.—MOVABLE ELECTRIC JIB CRANES.

The Docks Committee of the City and County of Bristol are prepared to receive TENDERS for the CONSTRUCTION, DELIVERY, ERECTING in PLACE, FITTING, TESTING, and MAINTENANCE for twelve months after completion, of FOUR 2-TON MOVABLE ELECTRIC JIB CRANES, to be erected on the Roofs of Sheds now in course of construction at Canons Marsh, Bristol, and ONE 3-TON MOVABLE ELECTRIC JIB CRANE, to be erected on the adjoining Wharf at Canons Marsh, Bristol.

On and after Wednesday, May 17th, 1905, copies of the specification, form of Tender, form of Contract, and copies of contract drawings can be obtained from the undersigned on production of a receipt from the Secretary of the Docks Committee showing that £5 has been paid as deposit. The deposit of £5 will be returned to *bonâ fide* Tenderers hereafter.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Electric Cranes," and addressed to the Secretary of the Docks Committee, 19, Queen Square, Bristol, and must be delivered to him, accompanied by the prescribed documents, before 10 a.m. on Wednesday, June 7th, 1905.

The Docks Committee of the Council of the City and County of Bristol do not bind themselves to accept the lowest or any Tender.

W. W. SQUIRE,
Engineer.

Engineer's Office,
Cumberland Basin, Bristol,
May 10th, 1905.

BOROUGH OF HORNSEY.—TO ENGINEERS AND IRONFOUNDERS.

The Town Council of the Borough of Hornsey are prepared to receive Tenders for the SUPPLY of 100 CAST-IRON LAMP COLUMNS.

Copies of the Tender form, drawing, and specification and full particulars may be obtained on application to Mr. E. J. LOVEGROVE, Borough Engineer and Surveyor, at the Municipal Offices, Southwood Lane, Highgate. No Tender will be considered except on the prescribed form.

Sealed and endorsed Tenders are to be delivered or sent by post so as to be received by me not later than 4 p.m. on Monday, the 5th of June proximo.

The Council reserve to themselves the right to decline all or any of the Tenders sent in.

F. D. ASKEY,
Town Clerk.

Town Clerk's Office,
Southwood Lane, Highgate, N.,
May 10th, 1905.

THE SOUTH INDIAN RAILWAY COMPANY, LIMITED, is prepared to receive TENDERS for the SUPPLY of—

(1) GENERAL STORES, comprising Hardware, Iron, Steel, Metals, Oils and Colours, Leather Goods, and Sundries.
(2) LOCOMOTIVE STORES, comprising Cranks, Copper and Steel Plates, Tires, Axles, Springs, Tubes, and Trollies.
(3) STATIONERY, comprising Books, Paper, Envelopes, Ink, and Sundries.
(4) FENCING, about 65 tons.

Specifications and forms of Tender may be obtained at the Company's Offices.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, and marked "Tender for General Stores," or as the case may be, must be left with the undersigned not later than 12 noon of Tuesday, May 30th, 1905.

The Company is not bound to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 20s. for each copy of specification No. 1, and of 10s. for each copy of Nos. 2, 3, 4.

Copies of the drawings may be obtained at the office of Sir GEORGE B. BRUCE, 3, Victoria Street, Westminster, on payment of 5s. per sheet.

By order,
HENRY W. NOTMAN,
Managing Director.

Company's Offices,
55, Gracechurch Street, London, E.C.,
May 12th, 1905.

ALDEBURGH CORPORATION WATER.

CONTRACT No. 3.
PUMPING MACHINERY.

The Corporation of Aldeburgh are prepared to receive TENDERS from competent Engine Builders and Machinists for the MAKING, ERECTING, SETTING to WORK and MAINTAINING in GOOD ORDER for Three Months, at the New Well, near Aldeburgh Hall Farm, of TWO "HORNSBY-ACKROYD" CHEAP FUEL OIL ENGINES, TWO "HAYWARD-TYLER" UNIVERSAL PATTERN PUMPS, with all necessary Gearing, Shafting, Pipes, Valves, and other Fittings.

The Drawings may be seen and Copies of the Specification and Bill of Particulars may be obtained at and after noon of Monday, May 1st, at the office of the Borough Surveyor, Mr. J. C. GORDON, Aldeburgh, or at the Office of the Engineers, Messrs. JAMES MANSERGH AND SONS, 5, Victoria Street, Westminster, on the deposit of Two Guineas, which will be returned after the receipt of a *bona fide* Tender with the Bill of Particulars fully priced out.

Early application for particulars is desirable, as only a limited number will be given out.

Sealed Tenders, endorsed "Tender for Pumping Machinery," are to be delivered at my office on or before noon of Friday, May 24th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

HENRY C. CASLEY,
Town Clerk

Aldeburgh, April 29th, 1905.

METROPOLITAN BOROUGH OF HACKNEY.

ELECTRICITY WORKS.

The COUNCIL of the Metropolitan Borough of Hackney are prepared to receive TENDERS for the FOLLOWING:—

SPECIFICATION No. 24.—Artesian Well and Air-Lift Pumping Plant.

General Conditions, Specification, Drawings, Form of Tender, and Form of Agreement may be inspected at the Offices of Mr. ROBERT HAMMOND, M.Inst.C.E., the Consulting Engineer to the Council, 64, Victoria Street, Westminster, S.W., and may be obtained there on or after Friday, May 5th, 1905, on making a deposit of £5, which sum will be refunded to *bona fide* Tenderers after the Tenders have been adjudicated upon. Extra copies of the Specification may be obtained by *bona fide* Tenderers at a charge of 5s. per copy, which sum will not be refunded.

Tenders, sealed and marked "Tender for Artesian Well and Air-Lift Pumping Plant," must be addressed to me at the Town Hall Hackney, and be delivered on or before 4 p.m. on Thursday, May 25th, 1905.

The General Conditions of the proposed Contract will contain a clause providing that the Contractor shall pay to all workmen wages at rates not less, and observe hours of labour not greater, than those recognised by the various trade unions and in practice obtained in the district where the work is produced or executed.

The Council do not bind themselves to accept the lowest or any Tender.

W. A. WILLIAMS,
Town Clerk.

Town Hall, Hackney,

ALDEBURGH CORPORATION WATER.

CONTRACT No. 2.—NEW ENGINE-HOUSE, RISING MAIN, &c.

TO BUILDERS AND CONTRACTORS.

The Corporation of Aldeburgh are prepared to receive TENDERS from competent persons willing to enter into a Contract for the CONSTRUCTION of a NEW ENGINE-HOUSE at the Well near Aldeburgh Hall Farm, together with about 870 lineal yards of CAST-IRON PIPES, 6 inches diameter, from the Engine-House to the existing Water-Tower, including Valve Chambers, Machinery Foundations, and other Works connected therewith.

The Drawings may be seen and copies of the Specification and Bills of Quantities may be obtained, at and after noon of Monday, May 1st, at the Office of the Borough Surveyor, Mr. J. C. GORDON, Aldeburgh, or at the Office of the Engineers, Messrs. JAMES MANSERGH AND SONS, 5, Victoria Street, Westminster, on the deposit of Two Guineas, which will be returned after the receipt of a *bonâ fide* Tender with the Quantities fully priced out.

Early application for particulars is desirable, as only a limited number will be given out.

Sealed Tenders, endorsed "Tender for Engine-House, &c.," are to be delivered at my office on or before noon of Friday, May 24th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

HENRY C. CASLEY,
Town Clerk.

Aldeburgh, April 29th, 1905.

PAGE'S WEEKLY — Contracts

TO ENGINEERS AND OTHERS.

THE METROPOLITAN ASYLUMS BOARD

invite TENDERS for ENGINEERING WORK, principally RE-ERECTION of existing MACHINERY in connection with Laundry and Kitchen Installations at the Southern Convalescent Hospital, Carshalton-on-the Hill, Surrey, in accordance with drawings and specification prepared by Mr. W. T. HATCH, M.I.C.E., M.I.M.E., Engineer-in-Chief.

Drawings, specification, conditions of contract, and form of Tender, may be inspected at the office of the Board, Embankment, London, E.C., on and after Wednesday, May 17th, 1905, and can then be obtained upon payment of a deposit of £2, but applications for same will not be entertained after May 31st, 1905.

The amount of the deposit will be returned only to persons who have sent in *bonâ fide* Tenders, and returned drawings and specifications in accordance with the regulations.

Tenders, addressed as noted on the form, must be delivered at the office of the Board not later than 10 a.m. on Wednesday, June 14th, 1905.

By order,
T. DUNCOMBE MANN,
Clerk to the Board.

May 10th, 1905.

METROPOLITAN BOROUGH OF ST. PANCRAS.

THE ST. PANCRAS BOROUGH COUNCIL

invite TENDERS for the SUPPLY of ARC LAMPS CARBONS for twelve months. Delivery to be made as required.

Copies of the specification, conditions of contract, and form of Tender, to be obtained upon application at the Electricity Department Offices, No. 57, Pratt Street, Camden Town, N.W., on payment of a deposit of £2, which will be refunded on the specification being returned, accompanied by a *bona fide* Tender.

Tenders to be sent to the undersigned, endorsed "Tender for Arc Lamp Carbons," by 12 o'clock noon on Tuesday, May 23rd, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

C. H. F. BARRETT,
Town Clerk.

Town Hall, Pancras Road, N.W.,
May 8th, 1905.

CORPORATION OF GLASGOW.

POLICE DEPARTMENT.

GLASGOW MAIN DRAINAGE.

MECHANICAL POWER FOR SHIELDHALL OUTFALL WORKS.

The Corporation of the City of Glasgow are prepared to receive

TENDERS FOR THE SUPPLY, DELIVERY, and ERECTION

of the following alternative EQUIPMENT of the MACHINERY BUILDINGS of the above Works.

First—STEAM INSTALLATION.

Steam boilers; mechanical stokers; superheaters; economiser; necessary steam, exhaust, feed, blow-off and water piping, with all valves, cocks, traps, etc.; feed pumps; feed tanks; high-speed, triple-expansion, surface-condensing, forced-lubrication engines and dynamos; high-speed, triple-expansion and compound surface-condensing, forced-lubrication engines and centrifugal water pumps, with all necessary platform and iron work, and all other work connected therewith. Or

Second—GAS INSTALLATION.

Gas producers, steam boilers, cooling syphons, scrubbers, washers, gas holder, gas engines and dynamos; gas engines and centrifugal water pumps, with all necessary platforms and iron work; all gas and water piping, with valves, cocks, etc.; starting gear, with accessories; silencers, ignition apparatus, cooling tanks, circulating water pumps, and all other work connected therewith. Or

Third—STEAM INSTALLATION, with Stand by GAS ENGINES worked with town gas.

Specifications and forms of Tender may be had on application at the Office of Public Works, City Chambers, 64, Cochrane street, Glasgow, by depositing the sum of Ten Guineas, which will be returned on receipt of a *bona fide* Tender.

Plans and drawings may be seen and further particulars obtained at the Office of the Consulting Engineer, Mr. W. D. HAMILTON M.I.Mech.E., 59, Bath Street, Glasgow.

Tenders, marked outside "Tender for Machinery, Shieldhall," must be lodged with the Town Clerk (Police Department), on or before Thursday, June 1st, proximo.

The lowest or any offer may not be accepted.

JOHN BOWERS,
Town Clerk.

City Chambers, Glasgow,
May 4th, 1905.

TO ENGINEERS AND OTHERS.

THE METROPOLITAN ASYLUMS BOARD

invite TENDERS for the INSTALLATION of ENGINEERING PLANT in boiler-house, engine, pump, and tank-rooms, etc., at the Southern Convalescent Hospital, Carshalton-on-the-Hill, Surrey, in accordance with drawings and specification prepared by Mr. W. T. HATCH, M.I.C.E., M.I.M.E., Engineer-in-Chief.

Drawings, specification, condition of contract, and form of Tender, may be inspected at the Office of the Board, Embankment, London, E.C., on and after Wednesday, May 17th, 1905, and can then be obtained upon payment of a deposit of £5, but applications for same will not be entertained after May 31st, 1905.

The amount of the deposit will be returned only to persons who have sent in *bonâ fide* Tenders and returned drawings and specifications in accordance with the regulations.

Tenders, addressed as noted on form, must be delivered at the Office of the Board not later than 10 a.m. on Wednesday, June 14th, 1905.

By order,
J. DUNCOMBE MANN,
Clerk to the Board.

May 10th, 1905.

APPOINTMENTS OPEN.

CITY OF MANCHESTER.—ELECTRICITY DEPARTMENT.

SHIFT ENGINEER.

The ELECTRICITY COMMITTEE of the MANCHESTER CORPORATION invite applications for the above position. Age not less than 25 years. Salary to commence at £150 per annum.

Candidates must have had a thorough mechanical training, and marine and three-phase experience would be a recommendation. His electrical knowledge must include both lighting and traction, and have been gained in central stations using units of not less than 1,000 kw.

Applications, stating age and experience, accompanied with two testimonials, to be addressed to the Chairman of the Electricity Committee, Town Hall, Manchester, endorsed "Shift Engineer," not later than Monday, 22nd inst.

WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
May 9th, 1905.

JOHANNESBURG MUNICIPAL ELECTRIC TRAMWAYS.

LIGHTING AND POWER UNDERTAKING.

The Town Council invites APPLICATIONS from persons having suitable experience for the following APPOINTMENTS, under three years' agreements.

The successful candidates will be required to devote their whole time to the Council's service.

Each application should be accompanied by a brief description of the applicant's training and experience and by suitable references.

Applicants should be prepared to take up their duties about the beginning of August next.

(A) A GENERAL MANAGER, to take charge of the entire tramway, lighting and power undertakings.

It is desirable that applicants should be engineers, but good business capacity and experience in tramway management are essential.

Gas engine and producer experience, if any, should be defined.

Salary, £2,000 per annum.

Half salary will be allowed from date of sailing to arrival in Johannesburg, but no travelling expenses.

Applications, clearly endorsed "(A) General Manager," are to be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and must be received by them not later than the first post on Monday, May 29th next.

(B) A STATION ENGINEER to take charge of the generating station and tramway workshops.

The station comprises gas producers, gas engines, direct-current and alternate-current generators of 13,000 B.H.P. capacity.

Experience with gas engines and producers is essential, and of both direct and alternate-current plant is desirable.

Salary, £1,000 per annum with house free.

Half salary will be allowed from date of sailing to arrival in Johannesburg.

Applications, clearly endorsed "(B) Station Engineer," are to be addressed to Messrs. MORDEY AND DAWBARN, 82, Victoria Street, Westminster, S.W., and must be received by them not later than the first post on Monday, May 29th next.

May 3rd, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N. 125, Strand, W.C.
World's Work and Play.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

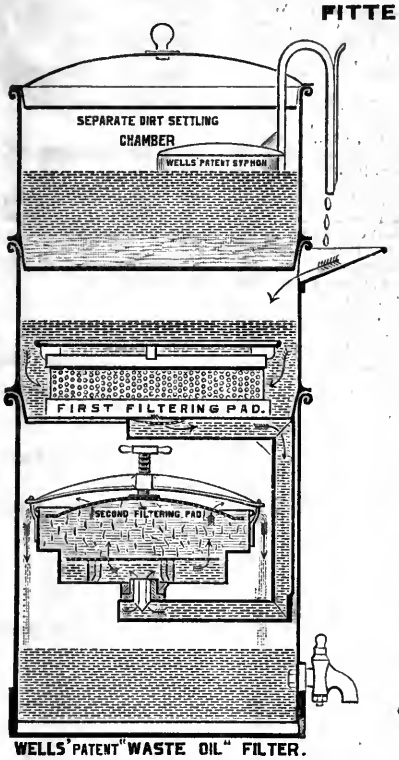
Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY — Wells' Specialities

WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.



WELLS' PATENT "WASTE OIL" FILTER.

SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.

OVER *10,000* SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.—For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in.	35/-
No. 2.—Two top chambers hold about 3 gallons oil, 22 in. by 10 in. ..	50/-
No. 3.—Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ...	70/-
No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ...	110/-
No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ...	189/-
No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

Capable of dealing with **250** Galls. Oil per week

LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6.	Handy Size. No Tank. On Wheels.	£7 7s.
No. 4.	Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals.	£8 10s.
No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

Price 13/8 per cwt.,

Carriage Paid in England and Wales, (If in lots of 3 cwt. at a time, 12/8 per cwt.)

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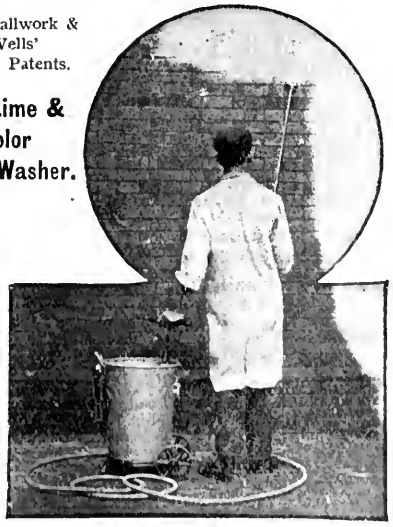
Wallwork & Wells' Patents.

Lime & Color Washer.



No. 4a, with Wheels.

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

Works: Cheetham, Manchester. LONDON, N.W.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Delghton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds, England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY — Aerial Ropeways

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AËRIAL ROPEWAYS

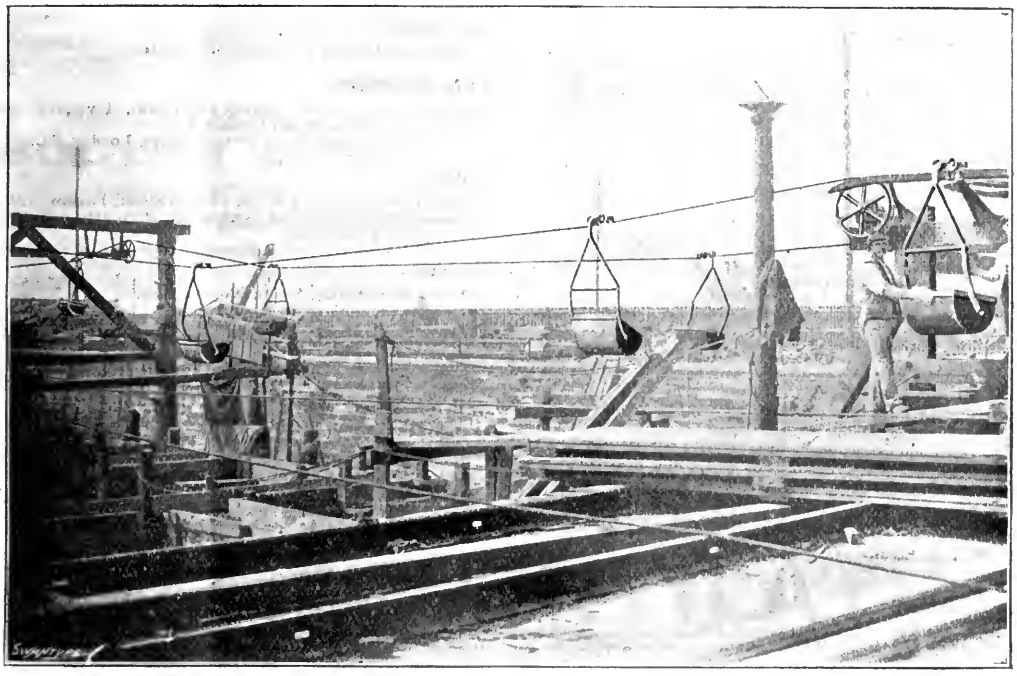
AND INCLINES ON ALL SYSTEMS

DESIGNED AND CONSTRUCTED BY

BULLIVANT & CO., LTD.

EXAMPLES AT WORK ALL OVER THE WORLD.

WRITE FOR PAMPHLET R.R.



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Ropeways constructed to convey from 50 to 2,000 tons per day. Suitable for the transport of all descriptions of materials.

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Flexible Steel Wire Ropes for Cranes, Lifts, Hoists, etc.

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Telephone: 2110 Avenue. LONDON.

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Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H. & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North, Birmingham.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Wiran, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham, England
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A Midland Road, St. Pancras, London, N.W

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester

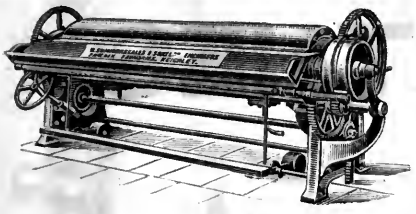
"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY — Machine Tools



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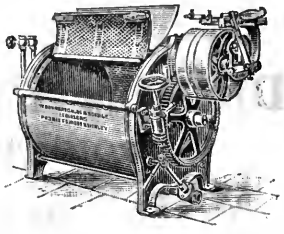
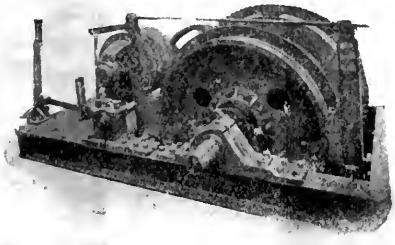


W. Summerscales & Sons, Ltd.,

Phœnix Foundry, KEIGHLEY, ENGLAND.

Electric Hauling GEARS



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M. B. WILD & CO., 35 and 36, Clarence Chambers, Corporation Street, BIRMINGHAM.

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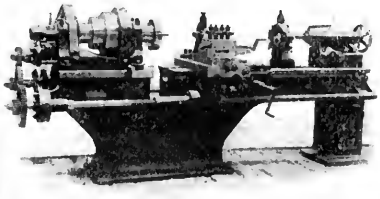

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D. MITCHELL & CO., Ltd., Parsonage Works, KEIGHLEY.

On War Office and India Office Lists.

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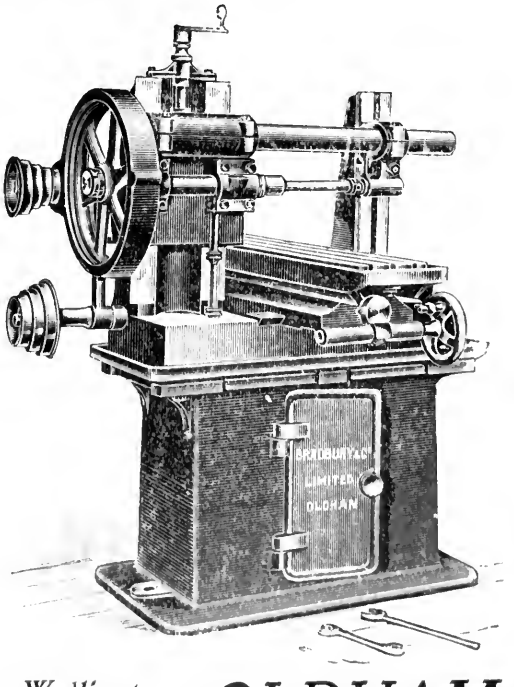
Newly Designed

Standard Milling Machine

For

SPEED,
ACCURACY,
ADAPTABILITY,

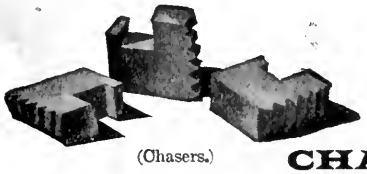
IS **A 1.**



Prices and Particulars from - -

BRADBURY & Co., Ltd., Wellington Works, *OLDHAM.*

HARTNESS

AUTOMATIC  DIES AND CHASERS.

(Chasers.)

The most satisfactory means yet devised for the production of screw threads.

The Hartness Automatic Dies produce a shape of thread accurate beyond measure; making it possible for the first time to measure screw threads by the use of the ordinary micrometer, ring, or snap gauge. This marks a most important step in the advancement of accurate machine construction. These Dies were designed expressly for the Hartness Flat Turret Lathe, but may be used in any of the existing screw machines by change of shank.

(A Group of Hartness Automatic Dies.)

The Hartness Automatic Dies are supplied in three sizes, viz., No. 1, for cutting screw threads from $\frac{3}{32}$ inch to $\frac{1}{2}$ inch in diameter; No. 3, for screw threads from $\frac{1}{4}$ inch to $1\frac{1}{4}$ inches in diameter, and No. 6, for screw threads from 1 to 2 inches in diameter. Right or left-hand chasers are supplied for cutting Whitworth Standard, Metric, V., Acme, and Pipe threads; also the various fine threads in customary use.

Every part of these Dies are made from the finest of tool steel, and are perfectly interchangeable throughout.

SEND POSTCARD FOR PRICE LIST.

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"JUBILEE BUILDINGS," 97, QUEEN VICTORIA ST.,

LONDON, ENGLAND.

PAGE'S WEEKLY

Machine Tools

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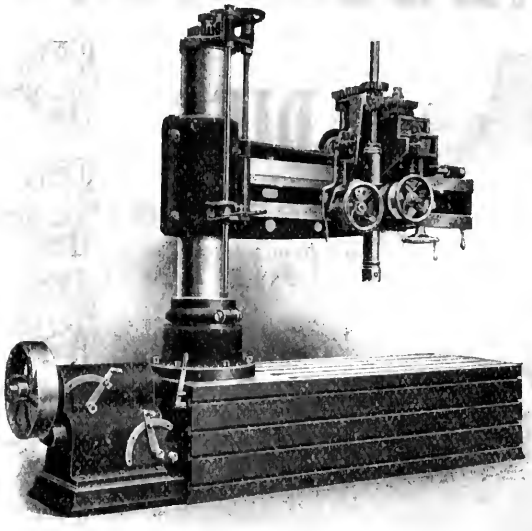
290, Claremont Road, HALIFAX.



Above is illustration of my **6' 0" Radial**, with sixteen Speeds and nine Feeds, all obtained instantly by levers.

There are several special features in this and other tools made by me, and shall be glad to send full particulars on request.

HIGH-SPEED LATHES

OUR SPECIALITY

HIGH-GRADE MACHINES

only, in stock for Immediate Delivery.

(Established 1871.)

C. REDMAN & SONS, Parkinson Lane, HALIFAX

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ALL VISITORS TO

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PATENT FRICTION CLUTCH

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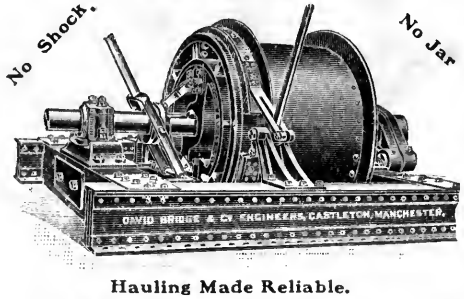
Sixty Page Work—Free.
DON'T MISS THIS.

Prevents Accidents.



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Castleton Iron Works,
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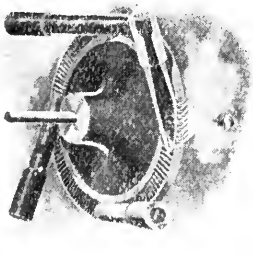
London Office:
35, Queen Victoria Street, E.C.

GREENWOOD & BATLEY, Ld.

LEEDS.



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Dynamos & Motors.

De Laval's Patent Steam Turbines.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS

TO MACHINE CLEAN & BRIGHT ALL OVER.

PARKER FOUNDRY CO. DERBY

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PAGE'S WEEKLY — Machine Tools, &c.

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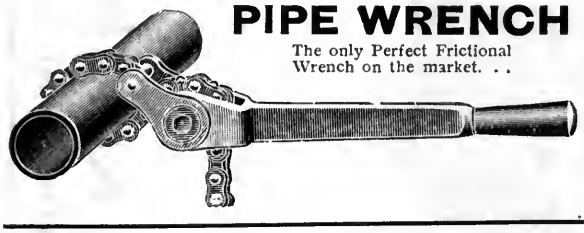
Machine Tool Makers, NEWCASTLE-ON-TYNE.

Sole Proprietors and Makers of

The "BEAR" Patent Smooth Grip

PIPE WRENCH

The only Perfect Frictional Wrench on the market. . .



BATEMAN HIGH-SPEED PLANERS

The Machine illustrated is

Cutting at 60 to 70 ft. per min. and

Returning at 200 to 220 ft. per min.

See our half-page Advertisement alternate weeks.

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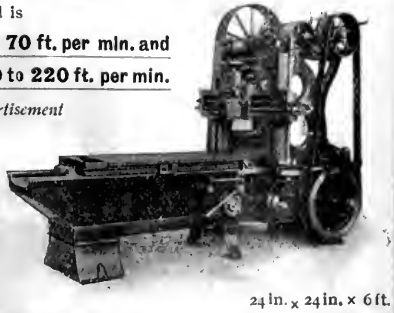

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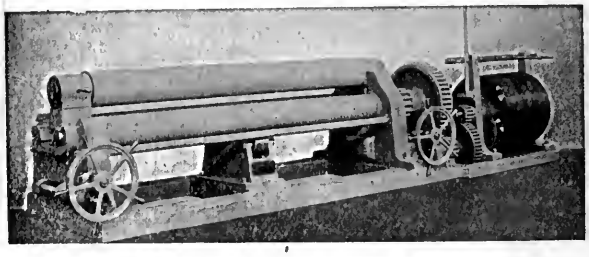

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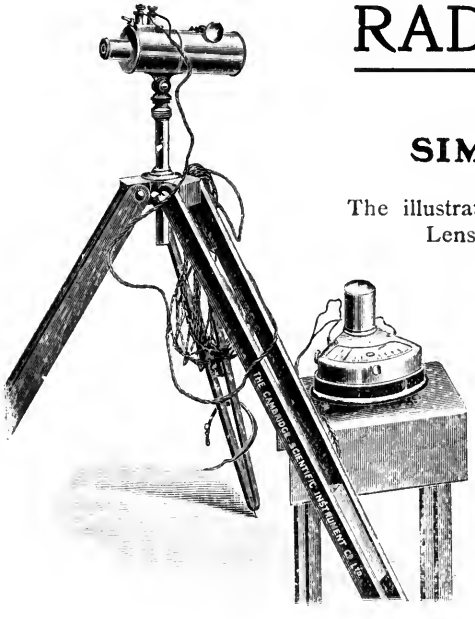

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Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY — Miscellaneous

Index to Advertisers—(Contd.)

PAGE'S WEEKLY

Miscellaneous

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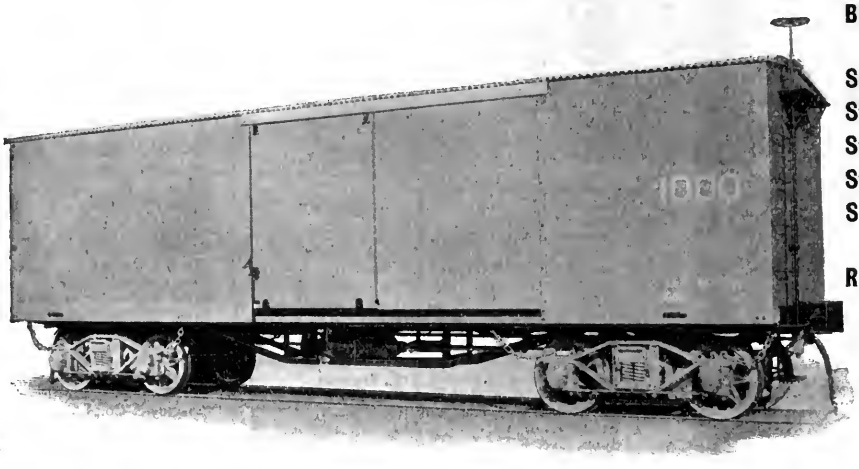

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VI. LONDON, FRIDAY, MAY 19, 1905. No. 36.

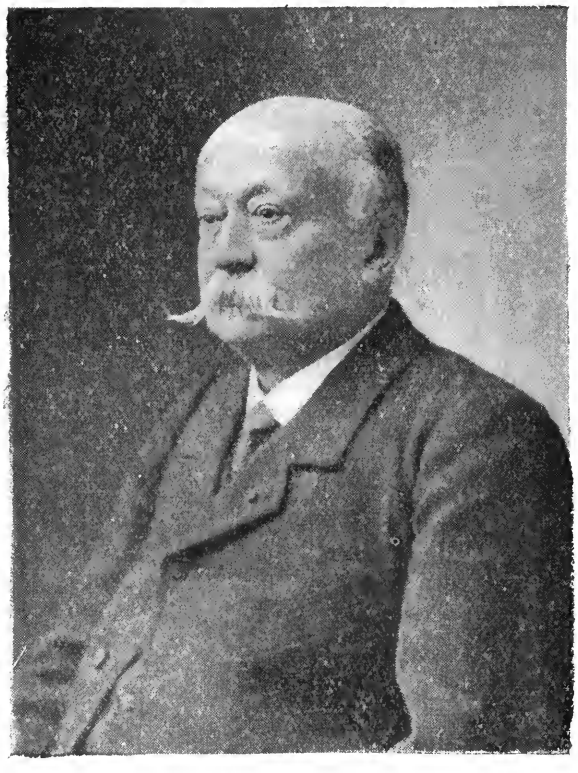
The Offices of "Page's Weekly," Wednesday Evening.

MUCH satisfaction is felt in France at the honours conferred upon prominent railway officials by His Majesty King Edward on the occasion of his recent visit to Paris. Mr. A. Sartiaux, general manager of the Northern Railway of France, has been appointed a Commander of the Royal Victorian Order, while Mr. Louis Bouverat, general superintendent of the line, has been enrolled in the fourth class, equal to officer, of the same order. Distinctions also been conferred upon Mr. Berquet, traffic manager of the Paris-Lyons-Mediterranean Railway, and Mr. Ruel, one of his chief assistants. Mr. Sartiaux is widely known both in this country and abroad, and as La Chronique remarks, it would take several columns to enumerate all the services which he has rendered not only to the Compagnie du Nord but also to the commercial interests of France generally. He is one of the principal actors in the great work of peace which is being accomplished by *l'Entente Cordiale*. Mr. Bouverat is not so well known on this side of the water, but that he is a power in French railway affairs will be understood when it is stated that he recently attained his fiftieth year in the service of the Northern Railway of France.

We recently referred to the pessimism of certain individuals who maintain that every branch of engineering is hopelessly overcrowded, and are glad to find on the authority of Mr. Hadfield that in the iron and steel world, as in other engineering enterprise

MR. ALBERT SARTIAUX, C.V.O.,
General Manager of the Northern Railway of France.

there is still plenty of room at the top. Speaking to the younger members of the Institute, Mr. Hadfield said: "I cannot but congratulate you upon the remarkable era in which you are commencing your career. Means of acquiring knowledge abound on every hand. There never was a time more favourable to the younger member, who is interested in his profession, and who is willing to work. It is said the profession is crowded, but, depend upon it, there is room for those who will but run steadily the race that is set before them. There is just as much opportunity now as there was for those who have gone before and have made their mark. The work is higher and more complex in this present age, therefore the more is trained help required. Remember always that nothing, not even the highest natural ability, will take the place of persistent hard work. Be interested in your profession, do not despise little points, keep hold of your subject, for continuity of effort is more than ever important. Study your technical journal strenuously, preserve and file those articles in which you are interested, for they may prove of the greatest value long after you might think they would be of no use. Are our younger men given the chance they should have in this country? I think not to the same extent as in America. There, responsibility is thrust upon them at a much earlier stage than here; this may have its disadvantages, but it certainly seems to be successful. Whilst there are, of course, some exceptions, there never was an age in which merit was better recognised. Depend upon it, therefore, there is room for you if you will but strive persistently and continuously."



MR. LOUIS BOUVERAT, M.V.O.

A propos of Mr. Mosely's career, we recently outlined the attitude of the essentially practical man to the classical side of public school work. The editor of a New York technical paper has just entered a protest against superfluous Latin and Greek with much force and acumen. He says: "The idea is even still deeply rooted that useful knowledge is all very well for the vulgar, but that a polite education requires to be of a material that cannot possibly be useful. A profound knowledge of extinct languages, for example, is still regarded as the index of a high education. As an evidence of this curious mental attitude, it may be remembered that both Oxford and Cambridge Universities have recently reinsisted upon a knowledge of ancient Greek as a necessary qualification for all entering students. That ancient Greek is an eminently proper and desirable study, like that of any other dead language which has occupied a prominent place in history, it would be idle to deny; but to insist that all aspirants to a high education should be compelled to study dead languages for years is ancestor-worship run

wild, and akin to the attitude of the Chinese, who in their annual national examinations for government appointments, are said to permit no student to discuss any book of less than two thousand years' antiquity." Greek has a certain utility and unlocks many doors; it offers a charming field for study. So also do scarabs and papyri, mastodons and cave-dwellers, but a practical man—a mining engineer, for instance—has a weighty task in keeping thoroughly *au fait* with every new detail of his profession and if he has devoted many of his early days to Greek he will be strongly tempted like Mr. Mosely, to look back upon the time so spent with regret and to ask *cui bono?*

In another column will be found a summary of Mr. Justice Grantham's judgment in the action—Graham, Morton and Co., Ltd. *v.* Compagnie L'Union Des Gaz.

Messrs. Graham Morton, it will be seen, have beaten their opponents in this legal duel all along the line, while the unequivocal utterances of the learned judge have deprived the baseless charges brought against them of the slightest claim to attention. Incidentally it has been demonstrated what an English firm can do in the face of well-nigh insuperable difficulties. Destruction threatened workers and work alike in this "hell on earth" at Milan, yet the contract was carried through, and was only finally annulled by bad working and foul play on the part of disaffected workmen. Whether Messrs. Graham Morton and Company feel compensated for the enormous worry which this contract must have entailed, is, we imagine, very doubtful, but they have, at any rate, the advantage of a very striking moral and intellectual victory.

Much instructive matter is contained in the recently issued report of the Lightning Research Committee. This has the advantage of a preface by Sir Oliver Lodge and is signed by John Slater, Chairman, E. Robert Festing, Oliver Lodge, J. Gavey, W. N. Shaw, A. R Stenning,

MR. ALFRED MOSELY, C.M.G.

"Looking into the future of our own country, I feel bound to record my belief that the *regime* of the past, however successful it may have been, is obsolete, Honesty, doggedness, pluck, and many other good qualities possessed by Britons, though valuable in themselves, are useless to-day unless accompanied by practical, up-to-date scientific knowledge, and such knowledge only becomes possible with an enlarged and enlightened system of education."

Extract from Mosely Commission Reports.

Arthur Vernon, Killingworth Hedges, Hon. Secretary, G Northover, Secretary. Incidentally the report states that absolute protection of the whole of a building can only be assured by enclosing the structure in a system of wirework —a contrivance, in fact, of the nature of a bird-cage. This should be well connected at various points to earth, as nearly all buildings have gas and water pipes and other metallic conductors

in their interiors which are likewise earthed. For structures intended for the manufacture or storage of gunpowder and other explosives the adoption of this birdcage protection would be justified on the score alone of public safety Architectural considerations prevent the adoption of such a method in its entirety for ordinary buildings; there is no doubt, however, that practically perfect protection may be assured by a judicious modification of the existing practice of erecting single lightning rods, especially in the case of extensive and lofty buildings that project well above surrounding structures, or that stand isolated in the open country.

The expense to be incurred in this protection must bear some definite relation to the importance or cost of the building itself. In cases where protection is considered desirable, but heavy expense is not justified, two or more lightning rods might be erected in the ordinary manner, these being connected by a horizontal conductor. Tall chimney shafts, the report states, are not efficiently protected by an ordinary single lightning rod, as a hot column of smoke issuing from a chimney conducts as well as or even better than a rod. A circular band should surround the top of the shaft; four or more conductors should be raised above the latter in the form of a coronal, or the continental practice of joining the elevation rods together, so as to form an arch over the chimney, may be employed with advantage. One or preferably two lightning rods should extend from this circular band to the earth.

The following practical suggestions are made by the committee as the outcome of their investigations: 1. Two main lightning rods, one on each side, should be provided, extending from the top of each tower, spire, or high chimney stack by the most direct course to earth. 2. Horizontal conductors should connect all the vertical rods (*a*) along the ridge, or any other suitable position on the roof; (*b*) at or near the ground line. 3. The upper horizontal conductor should be fitted with aigrettes or points at intervals of 20 or 30 feet. 4. Short vertical rods should be erected along minor pinnacles and connected with the upper horizontal conductor. 5. All roof metals, such as finials, ridging, rain-water and ventilating pipes, metal cowls, lead flashing, gutters, etc., should be connected to the horizontal conductors. 6. All large masses of metal in the building should be connected to earth either directly or by means of the lower horizontal conductor. 7. Where roofs are partially or wholly metal-lined they should be connected to earth by means of vertical rods at several points. 8. Gas pipes should be kept as far away as possible from the positions occupied by lightning conductors, and as an additional protection the service mains to the gas meter should be metallically connected with house services leading from the meter. The report can be obtained at 9, Conduit-street, Hanover-square.

The further report by the Carnegie Research Scholarship Committee has now been issued. The committee consists of Sir E. H. Carbutt, Bart., and Messrs. W. Whitwell, R. A. Hadfield, W. H. Bleckly, G. J. Snelus, F.R.S., and J. E. Stead, F.R.S. Having carefully examined the reports of the research work carried out by the holders of the Carnegie Research Scholarships during the past year, the committee consider that the report prepared by Dr. H. C. H. Carpenter (National Physical Laboratory) is deserving of the gold medal. They also consider that special silver medals should be awarded for the research carried out conjointly by Mr. Gunnar Dillner and Mr. A. F. Enström (Stockholm). The researches carried out by Mr. Brunton (Musselburgh) and by Mr. Rogers (Cambridge) are, they consider, of great merit. The committee further recommend that extension of time asked for for the completion of their reports be granted to Messrs. Roberts and Wraight, and to Mr. Rosenhain.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views.

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Foreign and Colonial Subscribers receiving incomplete copies through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, MAY 19.—North-East Coast Institution of Engineers and Shipbuilders, Newcastle. — Royal Colonial Institute: Anniversary Dinner, Hotel Metropole.—Royal Institution, 9 p.m.; Lecture by Sir Charles Eliot, K.C.M.G.

MONDAY, MAY 22.—Society of Arts, Cantor Lecture: "The Uses of Electricity in Mines"; Lecture Two. Mr. Ernest W. Ravenshaw, 8 p.m.

TUESDAY, May 23.—Society of Arts, Colonial Section.

WEDNESDAY, MAY 24.—Geological Society of London.

THURSDAY, MAY 25.—Institute of Electrical Engineers—Meeting, Society of Arts.

FRIDAY, MAY 26.—Physical Society of Royal College of Science, 8 p.m.

NEWS ITEMS.

Mr. James Gilchrist has been appointed to the Civil Engineering Lectureship of the University of Leeds, rendered vacant by the death of Mr. George Wilson.

Messrs. Kitson and Co., Leeds, are supplying five Atlantic-type locomotives for the London, Brighton, and South Coast Railway Company.

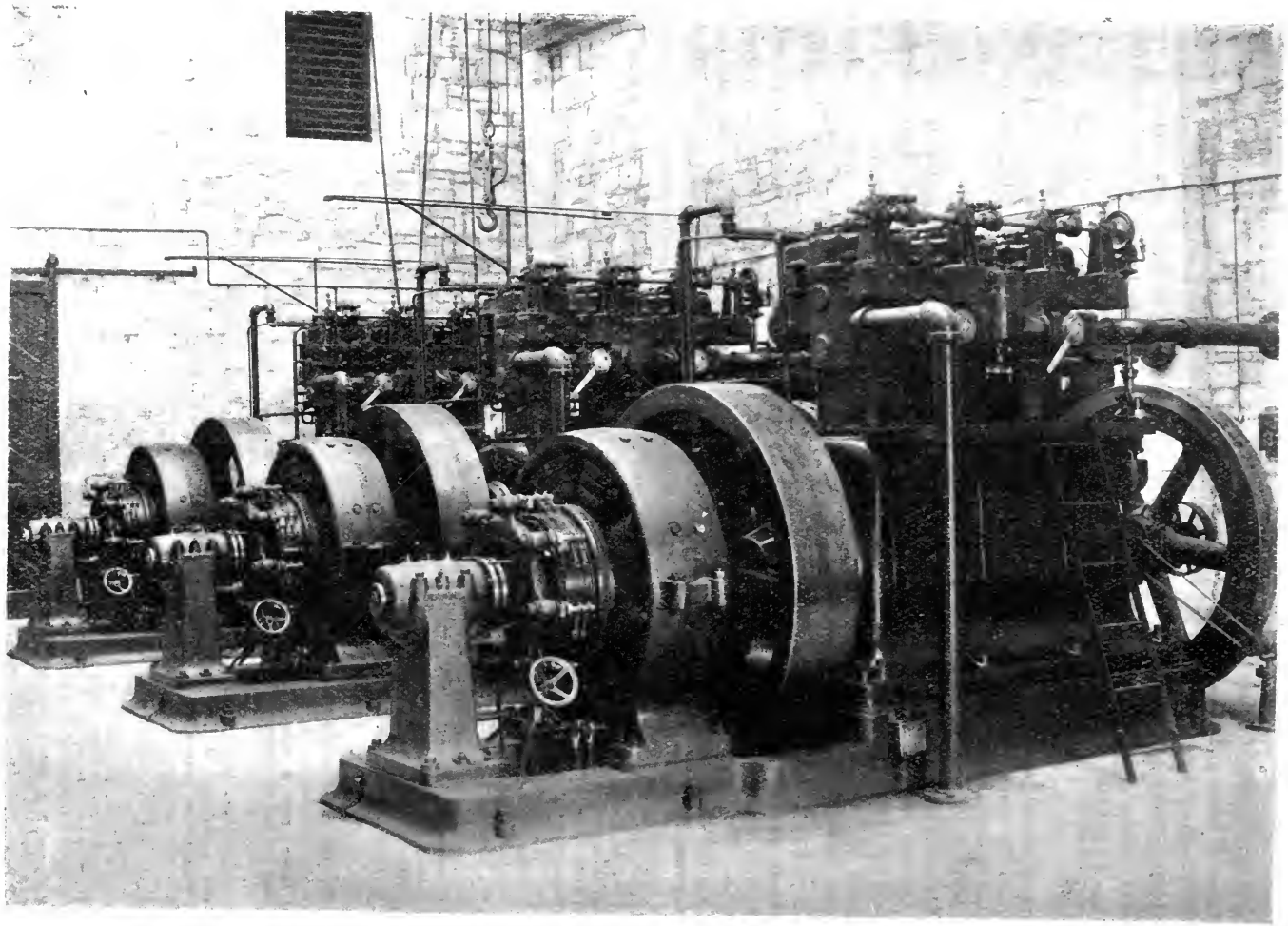
Messrs. Napier and Miller, Ltd, shipbuilders and engineers, of Yoker, Glasgow, have purchased about fifteen acres of ground at Old Kilpatrick, on the Clyde, for new works.

In the North Gallery of the Imperial Institute an exhibition illustrating British cotton cultivation and the commercial uses of cotton is being arranged in conjunction with the British Cotton Growing Association.

At the Optical Conference, which opens on May 30th, the papers are to include a contribution by Lord Rayleigh on the polishing of glass surfaces. The catalogue will include an account of the various types of optical, meteorological, and other scientific instruments manufactured in this country.

Scotch shipbuilders launched 36 vessels, of about 38,490 tons gross, during April, as compared with 29 vessels, of 45,640 tons gross, in March, and 34 vessels, of 39,424 tons gross, in April last year. During the first four months of this year Scotch builders have launched 90 vessels, aggregating 153,206 tons gross, as compared with 116 vessels, of 146,447 tons gross, in the corresponding period of last year.

CONTENTS.



THREE 75-K.W. CONTINUOUS CURRENT GENERATING SETS, DRIVEN BY GAS ENGINES, AT LIMERICK CORPORATION ELECTRICITY WORKS.

At this station the Electrical Company, Ltd., have installed three 75-k.w. continuous-current generating sets driven by gas engines. Each dynamo gives 75 k.w. at any voltage between 460/560. The machines are of the company's standard type with specially ventilated field coils. (*See page* 1059.)

Limerick Corporation Electricity Works.

On the opposite page we illustrate an interesting generating plant driven by gas engines at Limerick Electricity Works. The dynamos are of the Electrical Company's Standard type with specially ventilated field coils. The magnet frame is split in two halves which are securely bolted together. The end connections of the armature lie horizontally on the extension of the armature shell, which method affords a large radiating surface, facility in repairs and simplicity of construction. The dynamos are further equipped with the company's patent system of balancing whereby, if desired, each machine can be used to supply the 3-wire network direct without the use of rotating balancers. In this way the machines are automatically able to deal with an out-of-balance current amounting to 25 per cent. of the full load without there being any appreciable difference in pressure between the two sides of the 3-wire system.

Reported Openings for Mining Development in Italy.

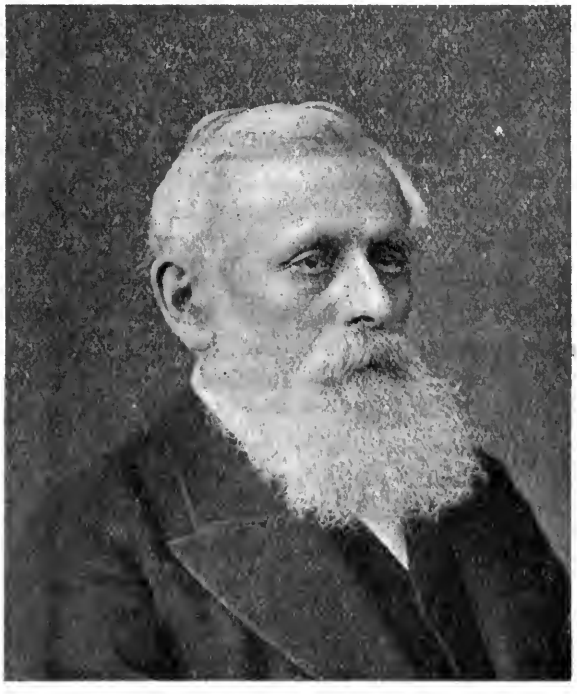
A report on the "Mineral Wealth of the Provinces of Siena and Grosseto," by H.M. Consul-General at Florence (Major W. P. Chapman) states that there are openings for developing the manganiferous iron ore deposits at Monte Argentario; the copper mining industry in the Leghorn district; and the quicksilver mining south of Monte Amiata. Mr. Chapman also calls attention to the prospects for the further utilisation of other minerals, viz.: antimony, sulphur boracic acid, fossil meal, and marbles.

Iron and Steel Institute.

The council, in their recent report, had occasion to congratulate several members of the Institute. The president (Mr. A. Carnegie) and Mr. E. Windsor Richards, past-president, have been elected honorary members of the Liége Association of Engineers; Sir James Kitson, Bart., M.P., past-president, has received the honorary degree of Doctor of Science of the University of Leeds; and the Duke of Devonshire has received the honorary degree of Doctor of Laws of the same university; Mr. A. Greiner has received the Grand Cross of the Russian Order of St. Stanislas, and the Commander's Cross of the Order of St. Olaf of Norway; Mr. G. Canet, honorary member, has been appointed a Grand Officer of the Imperial Ottoman Order of the Medjidieh; Mr. F. Baare (Bochum) has received the Cross of the Order of the Crown; Mr. R. Böcking (Saarbrücken) has received the title of Geheimer Kommerzienrat, and has also had conferred upon him the Grand Cross of the Order of the Lion of Baden; Mr. H. Goldschmidt (Essen) has been awarded the Elliott Cresson Medal of the Franklin Institute of Philadelphia; Mr. H. Grey (New York) has been awarded a gold medal for his rolling mill by the Société d'Encouragement pour l'industrie Nationale; Mr. J. Hallbauer (Lauchhammer) has received the title of Kommerzienrat; Sir James Heath, M.P., has had conferred upon him the dignity of a baronetcy; Sir Lloyd Wise has had a knighthood conferred upon him; Mr. H. Jacobi (Sterkrade) has received the title of Kommerzienrat; Mr. J. Jonas has been elected Lord Mayor of Sheffield; Dr. Ludwig Mond, F.R.S., has received the honorary degree of Doctor of Science of Victoria University, Manchester; Sir J. W. Swan, F.R.S., has received the honour of knighthood, and has been awarded the Hughes Medal of the Royal Society.

Tramway Exhibition.

The third International Electric Tramway and Railway Exhibition will be held at the Agricultural Hall, London, N., from Monday, July 3rd, to Friday, July 14th, 1905. Among the exhibits will be included many interesting designs which were not shown at the earlier exhibitions. These include several systems of surface contact tramways, new types of tramway cars, motor omnibuses, and a variety of small appliances for car equipment, overhead work, and track construction.



THE LATE SIR BERNHARD SAMUELSON. (See page 1067.)

Trade Returns for April.

The trade returns for April, 1905, when compared with those for the corresponding month of 1904, show a decrease in the value of the imports into the United Kingdom, and in the value of the exports of foreign and Colonial merchandise, but an increase in the value of the exports of British produce.

The value of the imports in April, 1905, was £43,282,826, a decrease of £1,898,937, or 4·2 per cent., as compared with April, 1904, whilst the total exports amounted to £30,442,345, or an increase of £203,141. The exports of British produce alone show an increase of £653,634, or 2·8 per cent., as computed with April, 1904, whilst there is a decrease of £450,493, or 6·7 per cent., in the exports of foreign and Colonial merchandise.

Comparing the values of the imports of articles last month with those of April, 1904, the chief increases and decreases include the following :—

Imports from Foreign Countries and British Possessions.*

	Month ended 30th April.			Increase (+) or Decrease (−) in 1905 as compared with 1904.	Increase (+) or Decrease (−) in 1905 as compared with 1903.
	1903.	1904.	1905.		
	£	£	£	£	£
II.—Raw Materials and Articles Mainly Unmanufactured—					
A. Coal, coke, and patent fuel ..	339	100	1,212	+ 1,112	+ 873
B. Iron ore, scrap iron, and steel ...	391,799	396,796	428,169	+ 31,373	+ 36,370
C. Other metallic ores...	476,527	594,875	488,757	— 106,118	+ 12,230
III.—Articles Wholly or Mainly Manufactured—					
A. Iron and steel and manufactures thereof	611,835	691,593	684,175	— 7,418	+ 72,340
B. Other metals and manufactures thereof	1,762,357	1,817,754	1,485,605	— 332,149	— 276,752
C. Cutlery, hardware, implements and instruments	404,415	463,043	296,387	— 166,656	— 108,028
D. Telegraph cables and apparatus	2,643	1,281	3,476	+ 2,195	+ 833
E. Machinery	403,942	350,570	465,024	+ 114,454	+ 61,082
F. Ships (new)	1,511	211	3,856	+ 3,645	+ 2,345

Exports of British Produce.

	Month ended 30th April.			Increase (+) or Decrease (−) in 1905 as compared with 1904.	Increase (+) or Decrease (−) in 1905 as compared with 1903.
	1903.	1904.	1905.		
II.—Raw Materials and Articles Mainly Unmanufactured—					
A. Coal, coke and patent fuel ...	1,977	1,240	2,493	+ 1,253	+ 516
B. Iron ore, scrap iron and steel ...	1,690,320	1,459,827	1,691,976	+ 232,149	+ 1,656
C. Other metallic ores...	1,945,333	2,359,526	2,446,466	+ 86,940	+ 501,133
III.—Articles Wholly or Mainly Manufactured—					
A. Iron and steel and manufactures thereof	2,676,473	2,653,273	2,656,313	+ 3,040	— 20,160
B. Other metals and manufactures thereof	5,973,193	6,667,366	6,700,757	+ 33,391	+ 727,564
C. Cutlery, hardware, implements and instruments	1,477,534	1,368,713	1,164,686	— 204,027	— 313,448
D. Telegraph cables and apparatus..	25,639	10,527	23,535	+ 13,008	— 2,104
E. Machinery	1,535,841	1,475,164	1,621,454	+ 146,290	+ 85,613
F. Ships (new)	14,810	5,570	4,696	— 874	— 10,114

*The values of the Imports represent the cost, insurance and freight; or when goods are consigned for sale, the latest sale value of such goods.

A Consular report from the Argentine Republic calls attention to the increasing demand for automobiles, which are being imported for the use of the post office, fire brigade, and the city ambulance.

Institute of Mining Engineers.

The forty-second general meeting of this institution will be held in London on Thursday, June 1st, at 11 a.m., and on Friday, June 2nd, at 10.30 a.m., in the Rooms of the Geological Society, Burlington House, Piccadilly, London, W. Arrangements have been made for visits to works, etc., on June 2nd and 3rd.

The papers to be read, or taken as read, on the Thursday are : (1) "The Firing of Babcock Boilers with Coke-oven Gases," by Mr. T. Y. Greener ; (2) "Compound Winding-engine at Lumpsey Mine," by Mr. M. R. Kirby ; (3) "Note Supplementary to a paper on the Electric Driving of Winding-gears," by Mr. F. Hird ; (4) "Electric Winding-engines at the Exhibition of the North of France, Arras, Pas-de-Calais," by Mr. Ed. Lozé ; (5) "The Education of Mining Engineers in the United States," by Professor Howard Eckfeldt ; (6) "An Outline of Mining Education in New Zealand," by Professor James Park ; (7) "Goaf-blasts in Mines in the Giridih Coal-field, Bengal, India," by Mr. Thomas Adamson.

On the Friday the following papers will be presented : (8) "The Conveyor-system for filling at the Coal-face, as practised in Great Britain and America,' by Messrs. W. C. Blackett and R. G Ware ; (9) "Underground Fires at the Greta Colliery, New South Wales," by Mr. J. Jeffries ; (10) "The Geology of Chunies Poort, Transvaal," by Mr. A. R. Sawyer ; (11) "Underground Horses at an Indian Colliery," by Mr. Thomas Adamson ; (12) "Description of the Eimbeck Duplex Base-line Bar," by Mr. William Eimbeck.

A number of additional papers will be open for discussion on both days.

The first excursion undertaken will consist of a stroll to Holborn to see the Cullinan diamond. The tunnel works of the Great Northern, Piccadilly, and Brompton Railway will be visited, and members will also make an inspection of Lot's Road power station.

The secretary, Mr. M. Walton Brown, is issuing details of the arrangements made with the principal railway companies for reduced fares to Liége in connection with the International Congress of Mining Metallurgy Engineering and applied Geology.

The American Institute of Electrical Engineers.

The American Institute of Electrical Engineers holds its annual meeting at Asherville, N.C., from June 19th to 23rd next. On June 20th the American Society of Civil Engineers commences its Cleveland meeting.

TECHNICAL SOCIETY NOTES.

The proceedings at the opening of the annual meeting of the Iron and Steel Institute commenced somewhat gloomily with a vote of condolence with Lady Samuelson on the death of Sir Bernhard Samuelson, who was one of the Institute's past-presidents and had been associated with it for many years. Before Mr. Hadfield settled down to his presidential address, preliminary proceedings extending over an hour had to be disposed of.

Mr. Carnegie was in quite a happy vein. His nationality seems to break into meetings with the persistency of King Charles's Head, but in view of Mr. Carnegie's happy pronouncement at this meeting, it is to be hoped that the matter has been finally set at rest. Mr. Carnegie said he was more favoured than most Americans as he had the advantage of being born in Scotland. How small these distinctions among the English speaking race appear to Mr. Carnegie, was made abundantly clear. He has travelled everywhere among colonials and cousins, and his mature opinion is that we are all the same. As for the possibility of war between English people and Americans, it is "unspeakably impossible."

In allusion to Mr. Hadfield's statement that he had been the first non-English president of the Institute, Mr. Carnegie said he hoped in the future it might become still more cosmopolitan in that respect, and that a Frenchman, a German, or a Swede might be called upon to occupy the presidential chair—a statement which evidently produced a favourable impression upon the meeting. The tribute paid to "this incomparable secretary," as Mr. Carnegie termed Mr. Brough, was endorsed unanimously by the meeting. Mr. Brough impressed everyone during the American visit by showing what he could do in the way of organisation long after the rest of the party had retired to bed, and at the annual meeting he once more gave evidence of his abilities as an organiser. By the way, a sketch of Mr. Brough's career appears in this issue.

A munificent further donation of £5,000 to the research fund by Mr. Carnegie was calculated to exhilarate the temper of the meeting, and Professor Arnold's humorous reminiscences on receiving the Bessemer medal had the same tendency though in a different way. Members will have an opportunity at the autumn meeting of inspecting those wonderful laboratories at Sheffield, but in the meantime Professor Arnold's promised description will be awaited with interest.

Considerable interest naturally attached to the President's paper on the effect on the mechanical and other properties of iron and its alloys produced by liquid air temperatures. Until quite recently carbon was the only element which modified the properties of iron, but these experiments show that nickel has a phenomenal effect, and that the treble combination of nickel-manganese with iron appear to reverse all the known laws of iron alloys. Professor Barrett referred in terms of high praise to the original character of the research undertaken, and told the meeting that one of the alloys was perhaps the most remarkable ever given to the world, and that in thermal and electrical resistance it was superior to anything hitherto known. Such a discovery is likely to prove of immense value. The other papers are referred to in our news columns, and it was made clear that the Sheffield meeting of the Institute is being awaited with keen anticipation.

INSTITUTION OF MINING AND METALLURGY.

FUTURE OF THE SCHOOL OF MINES.

THE annual dinner of the members of this institution was held on May 10 at the Hotel Cecil. The President, Mr. W. Frecheville, was in the chair. After the usual loyal toasts, Lord Londonderry, in proposing "The Institution of Mining and Metallurgy," referred to the work of the committee appointed by the Government to consider the co-ordination of the Royal College of Science at South Kensington with other existing and future institutions for higher scientific and technological instruction in London. Under the skilful chairmanship of Mr. Haldane, an interim report had been presented to him by the committee dealing with certain broad questions arising in this most difficult and interesting problem. It would, he knew, interest them to hear that the Government had definitely informed the committee that, provided satisfactory arrangements could be arrived at for the due co-ordination of the work of the various higher scientific teaching institutions in London and elsewhere, and provided that guarantees were obtained for the adequate management of what would practically be a congeries of highly organised technical courses, and, further, for the provision of a thoroughly satisfactory annual income for the upkeep of a great centre for this higher work, the Government were prepared to entrust the management of the Royal College of Science, including the Royal School of Mines, to a committee to be newly established for the purpose, which should bring the work of the Royal College and School of Mines into the closest possible relations with that of the other higher teaching institutions. In that way they might attain to a higher degree of co-operation and co-ordination in this important portion of the educational field. He was also glad to be able to announce that he had good grounds for believing further that the Treasury, or rather the Chancellor of the Exchequer, had been very carefully considering the financial aspect of the new condition of things that would be brought about in regard to the Royal College of Science if the changes which he had hinted at, actually took effect; and that they would see their way to making a reasonable increase in the sums at present annually devoted towards the expenses of the Royal College of Science. Thus the Royal College, in its immensely enhanced possibilities of usefulness owing to its large new buildings, might bring to the common aim, so to speak, not only its fabric and its excellent equipment and, of course, its own momentum and goodwill and prestige, but also a satisfactory annual income as a substantial contribution to what must be the heavy annual expenditure involved in the great work to be carried on for higher scientific and technological education in the metropolis.

PRESIDENT ON THE WORK OF THE INSTITUTION.

The President, in responding to the toast said, that every member of the Institution would be glad to hear that endeavours were to be made to make the School of Mines worthy of the industry and the Empire. They hoped that mining engineers might have some voice in directing what the studies of the mining engineer of the future should be. The Institution had taken considerable interest in the Bessemer memorial, and he believed it was proposed to utilise the funds contributed, first of all in erecting a memorial to Besemer, and secondly, in thoroughly equipping a metallurgical laboratory. A new undertaking which was now engaging the attention of the Institution was that of standardising the various weights, measures and terms used in the mining and metallurgical industry. The need for this was clear enough. There were at present three "tons" in use; the long ton of 2,240 lb., the metrical ton of 2,204 lb., and the short ton of 2,000 lb. Indeed, it might be said that there were four "tons," because the copper smelters had another of 21 cwt., by which they liked to buy their ores. Another instance of the need for standardising was in the case of screens; the term 40, 60 or 80 mesh did not define the size of the opening because the thickness of the wire was not known, there being no standard in that respect. Then, again, the inclination of lodes was measured sometimes from the horizontal plane, sometimes from the vertical. In this standardising reform they were endeavouring to carry colonial and American mining men with them, and to reach conclusions which would enable the recommendations made to be adopted in all English speaking countries, and to secure the general adhesion of mining engineers throughout the world.

Mr. R. B. Haldane, K.C., M.P., proposed the toast of the "Mining and Metallurgical Industries."

Lord Harris and Sir Thomas Wrightson, Bart., M.P., responded to the toast.

Mr. Edgar Taylor proposed "Scientific and Technical Societies," which was acknowledged by Sir William White. The other toasts were those of "Our Guests," acknowledged by Sir William Preece; and "The Chairman."

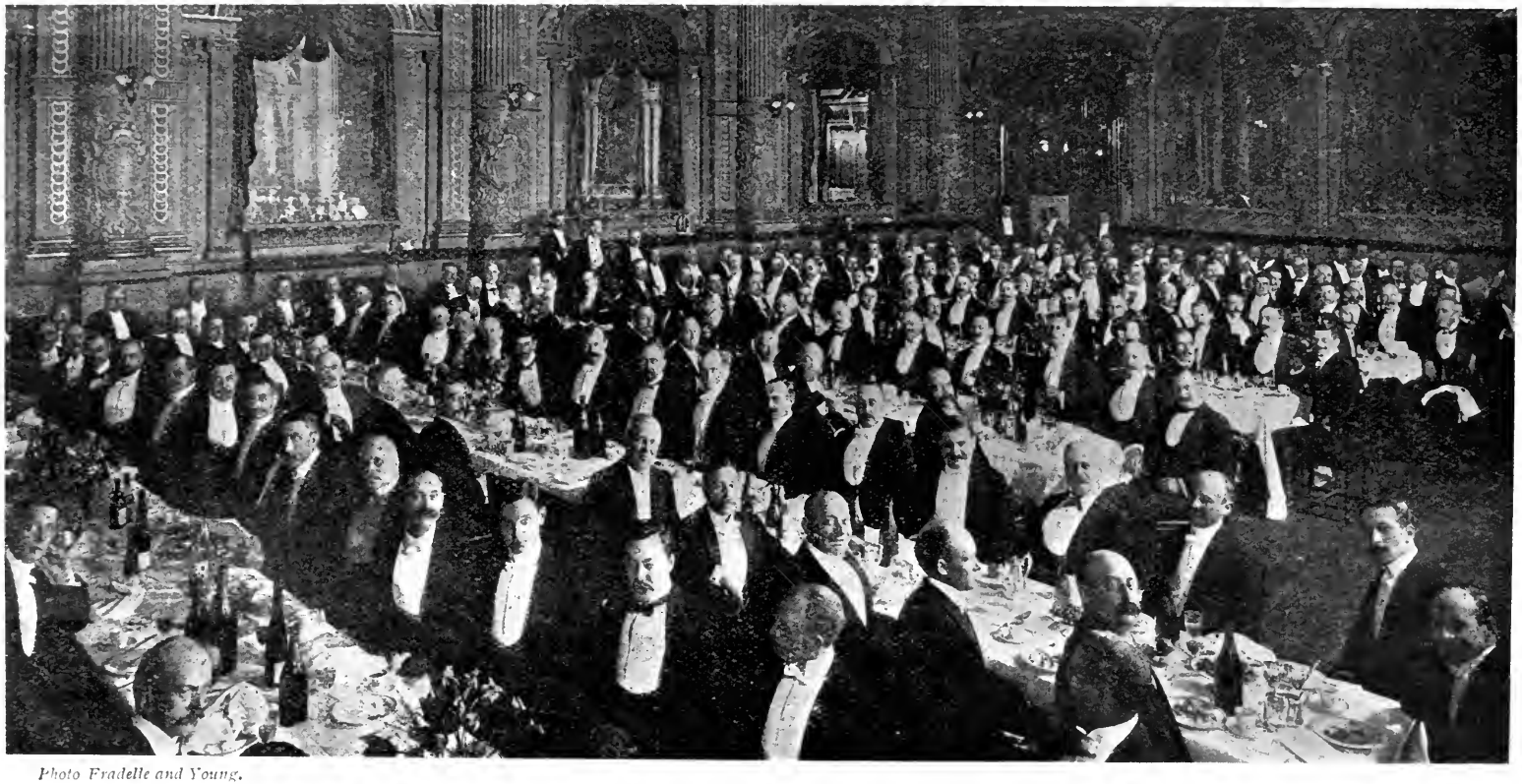


Photo Fradelle and Young.

INSTITUTION OF MINING AND METALLURGY—ANNUAL DINNER.

The names of those at the top table reading from left to right are: Mr. F. W. Green, Mr. A. Little, Mr. Sidney Farrar, Professor John Perry, Mr. C. Algernon Moreing (past president), Mr. R. L. Morant, Right Hon. Sir West Ridgeway, Sir William H. White, Right Hon. R. B. Haldane the Marquis of Londonderry, the President (Mr. William Frecheville), Lord Harris, Sir Thomas Wrightson, M.P., Sir William H. Preece, Mr. Edgar Taylor (vice-president), Mr. Almeric W. FitzRoy, Mr. F. G. Ogilvie, Mr. B. Kitzinger, Professor W. E. Ayrton, Mr. Benedict Kitto, Mr. Frank Safford, deputy-president of the Society of Chemical Industry, Professor H. Bauerman.

Among the others present were Messrs. Walter McDermott (past president), Arthur C. Claudet (vice-president), Alfred James (vice president), C. J. Alford (vice-president), Professor A. K. Huntington (past president), Mr. Bedford McNeill, Dr. Steinhart, Professor M. Curry, Sir Charles Crauford, Messrs. W. Fischer Wilkinson, A. G. Charleton (past president), Edward Hooper, A. L. Pearse, T. H. Leggett (vice-president), H. C. Jenkins, Harold Jeans, G. H. B. Kenrick, George A. Stonier, R. C. Feilding, Harold L. Twite, Julius L. F. Vogel, T. C. Cloud, R. E. Commans, H. L. Sulman, S. Herbert Cox (past president), J. C. G. Sykes, Percy Ashmore, Leslie A. Swinney, W. Worbey Beaumont, J. H. Fennell, L. Parker, J. H. Cordner-James, Robert Taylor, Arthur E. Taylor, Henry C. Taylor, Professor Thomas Turner, Professor R. A. S. Redmayne, and C. McDermid (secretary).

REMARKABLE ENGINEERING DISPUTE.

SEQUEL TO MILAN "PANDEMONIUM."

IN the High Court of Justice, King's Bench Division, on Monday, Mr. Justice Grantham gave judgment in the action Graham, Morton and Co., Ltd., *v.* Compagnie L'Union Des Gaz. The case was a remarkable one and the comments of the learned judge were of exceptional interest to engineers.

Mr. Rufus Isaacs, K.C., M.P., Mr. J. A. Simon and Mr. A. M. Paddon (instructed by Messrs. Spyer and Sons) appeared as counsel for the plaintiff. Mr. J. A. Hamilton, K.C., and Mr. A. H. Spokes (instructed by Messrs. Waterhouse and Company), were for the defendants. The following is an abstract of the judgment :—

The original claim of the plaintiffs for £1,483 5s. 4d. is admitted and is not in any way in dispute. but the defendants contend that the plaintiffs have failed to perform certain large contracts for the erection at Milan of four benches of retorts, containing in all 288 retorts, the contract price for which was £77,656, and that in consequence of that failure they, the defendants, are entitled to heavy damages. By the contract, the benches were all to be tested by the defendants for 30 days, and the balance of the contract price, less £4,000 of retention money, was to be paid by defendants to plaintiffs on the provisional acceptance of the said installation by the defendants. That £4,000 retention money was to be paid to the plaintiffs two years after the installation had been provisionally accepted, subject to any inherent defects developing themselves during that period in the working of furnaces. After the action was commenced, an additional claim for £4,000 has been added to the original claim for £1,483 5s. 4d., in consequence of the two years having elapsed since the date of the provisional acceptance, so that the plaintiffs now claim £5,483 5s. 4d. The defendants, therefore, suggesting no defence at all to the claim for the £1,483 5s. 4d., say that, in answer to that claim and the claim for the £4,000, they are entitled to large sums amounting to something like £70,000 for damages because the plaintiffs did not fulfil their contract, which was, in the main, to provide an installation of gas retorts which would carbonise 300 kilos of dry coal used at Milan in 6 hours, or 240 in 4¾ hours, by an expenditure not exceeding 15 lb. of coke per 100 lb. of coal carbonised. That practically is what the contract was for, and the plaintiffs undoubtedly guaranteed that result from the proper working of their installation. They also guaranteed many details in construction, all of which affected more or less the specific performances of the installation above mentioned, as to the quantity of coal carbonised. If the installation would do that work, it may be taken that the contract was performed, for, if it failed in the other guaranteed details above mentioned, it is pretty certain that it would not perform the work guaranteed.

The history of the case is very remarkable, and as far as my experience is concerned quite exceptional, and does not reflect very great credit on the defendants in making such serious charges against a firm who did so much as it was admitted by the defendants' witnesses the plaintiffs did to assist the defendants in fulfilling their own contracts with the authorities at Milan. It is true that people must be just before they are generous, but in their efforts, I suppose, to be just to their shareholders they certainly have not been generous in their dealings with the plaintiffs as far as their defence in this action is concerned. Never was an instance in which work of such magnitude was done under such difficulties as this work was begun, continued, and completed by the plaintiffs. Never were contractors, according to the evidence of the defendants' engineers, so anxious to fulfil their obligations and spend their money lavishly to enable them to carry out loyally their contract with the defendants. Never did such work receive such commendation by the persons for whom it was done during its progress, and after it was completed as in this case. Yet two years afterwards—or it may be a year or eighteen months afterwards—without the slightest complaint until they were asked for the payment of money admitted to be due, and that had accrued to the plaintiffs, they accuse the plaintiffs of what amounts to the grossest fraud in the construction and erection of these works. Instead of using good and contract material, they say they used

bad material, bad bricks, broken bricks, chippings of bricks, common bricks, and, in fact, rubbish in general, where they ought to have used different material and bricks of a different character, and in places which are subjected to almost the greatest heat that any work can be subjected to in this or any other country. I daresay they did use half or broken bricks for many of the fillings, but the defendants seem to forget that the best builders the world has ever known, viz., the Romans, almost invariably used similar pieces of brick for their fillings. If they had, in my judgment, used them in any place where it was injurious to use them, I should have to that extent found damages for any injury the defendants had sustained, but, in my judgment they did not.

That the installation has not answered the expectations of the defendants I think is probable, though as far as I can tell they have made a very great saving in the cost of the gas produced by it as against their old installations. That many parts of the works on their demolition have shown serious faults, has, I think, been proved, but considering that before they were completed the defendants' own engineers expressed their fear that the unfair treatment that the works had received in the past they would receive from the Italian employees of the defendants' firm in the future, fully justifies me in saying that the defendants had failed to convince me that any of the injuries or signs of bad workmanship they gave evidence about were due to original bad construction by the plaintiffs, but I find they were caused by bad treatment and bad workmanship on the part of the defendants' employees over whom it was practically impossible for the defendants to have proper or complete control, or to prevent them wilfully working the installation in such a way as to be injurious to the various portions of the work, and so to insure that the new labour saving appliances should not fulfil the results expected of them, in the hope that thereby the more work would be provided for the men.

The whole history of the case brings to light one of the most serious difficulties between capital and labour that I have ever had to deal with, and should be a warning to those who are legislating on trade disputes. The strike of the workmen in Italy is historical, and the fights that took place between the strikers and the authorities, whether regal or municipal is equally well known, and while the desirability of using labour saving machinery as much as possible is so manifest, yet that its erection would be strenuously opposed, and would be injured when completed, is equally certain.

The defendants were in fact in this dilemma. They were under heavy penalties to the Municipality of Milan. The conduct of the trades unions in Milan made it almost impossible for them to carry out their contracts. The chairman of the company, Mr. Lucas, had been out there to endeavour to bring peace, but considered himself, to use his own expression, lucky to get home again. They most naturally, therefore, looked to labour saving machinery as their sheet anchor in the future, and naturally and properly sent their most experienced engineers to see the best labour saving machinery in action that had been introduced into any country. They went to Edinburgh and saw the plaintiffs' work there, which is, according to the chief engineer in Edinburgh, the most perfect and successful installation that has been erected, and they not unnaturally ordered it. But they omitted one important element in their calculation. The installation was there worked by capable, skilled and honest workmen, whereas at Milan, they were certain to have incapable, unskilled, and dishonest workmen, men who because they thought their daily bread would be taken from them by the introduction of this labour-saving machinery felt themselves justified in wrecking it in every way they could.

What were the conditions under which the plaintiffs had to perform the work? They were these. Every Englishman they employed had to carry a revolver; every piece of work done had to be guarded; every bricklayer had to be paid £4 a week, besides food and lodging, whether they worked or were kept idle in consequence of the bad workmanship of the Italians under them; many of them were stabbed while at their work; and work finished off or performed one day or night was constantly broken up directly afterwards. Take as an example the use of torches to fire the gas at certain stages to prevent explosions in the retorts, explosions which, according to all the reliable witnesses for the defendants are injurious to the setting as distinguished from the retorts. These torches were provided over and over again, but the men, as often as they were provided, made away with them so as not to be able to use them until at last the defendants' manager gave up the use in despair and allowed the explosions to go on uninterruptedly for over twelve months. In fact, I think I can best summarise the conditions under which the work was done by the plaintiffs and under which the user of the installation was afterwards carried on by the defendants, according to the evidence of the defendants' own witnesses, by saying that instead of its being properly called by such a heavenly name as "San Celso" it was, as the chairman of

the defendant company called it, "pandemonium," —in other words, a hell upon earth.

It is admitted that the whole success of the installation depends on the proper use of the dampers to regulate the draughts, yet it is also proved up to the hilt that they were almost invariably used by the workmen in an improper way, and that by occasional improper using you may get fusing of the internal workings of a most serious kind. I have said nothing as to the fact that this installation is founded on the installations in Edinburgh and Leeds where it works properly, and to the still more important facts that Mr. Herring, with the great experience that he has had through life, and especially at the Edinburgh gasworks, and Mr. Hulse in the some position at Leeds, and a great number of witnesses of the highest eminence and reliability, all speak positively that there is no inherent defect in the plaintiffs' installation, and that the signs of injury seen on the destruction of the furnaces were not due to bad original workmanship by the contractors, but to bad working and foul play since the installation was completed. Their evidence and the evidence of the other witnesses called by the plaintiffs, would compel me to arrive at that result, but as the onus is on the defendants of proving their case, and the evidence of their witnesses is so unreliable and inconsistent with their original reports, I think it unnecessary to go more fully into the evidence of the plaintiffs' witnesses.

After such conduct on the part of the defendants, how can I now say that they are entitled to damages at the hands of the plaintiffs? What are they to have damages for? Is it for faulty workmanship, faulty nostrils, faulty ducts, or faulty furnaces? In each of such parts of the installation, bad workmanship by the defendants' employees was, I am convinced, the primary cause of the injury or faultiness that showed itself when the benches were destroyed. How can I divide it? How can I attribute £5 or £10 or £100 to this or that portion of the damages? If, as the planitiffs said, such injury as the defendants alleged had been caused by their omission, a sum of about £500 would have enabled them to put it right. I might have deducted that sum from the plaintiffs' claim, and should have done so if I was convinced that any specific injury could be primarily or at all traced to their faulty working, but as I cannot see where I can justly say that it was, I should not be justified in making any such deduction. I have no doubt that if the defendants had communicated with the plaintiffs before they began to alter the furnaces, the plaintiffs would have met them not only fairly but, as Mr. Green said they had done during its construction, most liberally, if not lavishly, as they thought more, according to him, of their reputation than their profit, and considering that the very heavy cost the plaintiffs must have been put to over this trial over and above what by our system of taxation they will be able to recover, I should be guilty of great injustice if, for the sake of salving the honour of the defendants, I had made any deduction from the plaintiff's claim that I did not think the defendants had justified. For these reasons, my judgment is for the plaintiffs on the claim and counter-claim, and with costs.

In response to an application by Mr. Rufus Isaacs his lordship said he thought this was a case in which he ought specially to say that the witnesses should be paid proper remuneration and that his order should be that the taxation should be on the higher scale, subject, of course, to the Taxing Master.

A MARINE MOTOR CLUB FOR GREAT BRITAIN.

We are pleased to chronicle the formation of a new club for dealing with marine motor matters. The birth of the club dates from the meeting held on Monday evening last at the offices of the parent organisation, the Automobile Club, and after Dr. Boverton Redwood had explained the aims and objects of the new departure, over fifty names were handed in as original members. The meeting then proceeded to the adoption of rules and the election of officers. Dr. Redwood being unanimously elected Vice-Commodore, and Lieut. Mansfield Cumming as Rear-Commodore. The post of Commodore remains vacant for the moment as it is hoped that a distinguished personage may accept that office. Some discussion took place as to whether members of the trade should be debarred from sitting on the Committee, Mr. S. F. Edge expressing a strong feeling that this should be made a rule. This proposal, however, met with some opposition, and no real decision was come to in that respect, although it may be pointed out that the ten members of the committee elected on Monday evening are nearly all unconnected with the trade. The committee at present consists of Messrs. F. R. Bircham, H. L. Clark, J. M. Gorham, Linton Hope, Bernard Redwood, Lionel de Rothschild, H. G. A. Rouse, George F. Sharp, H. C. Tower, Major F. Lindsay Lloyd, and Captain R. T. Dixon. Mr. Basil H. Joy was appointed hon. treasurer and secretary pro tem. The meeting was adjourned to June 19th.

OBITUARY.

SIR BERNHARD SAMUELSON.

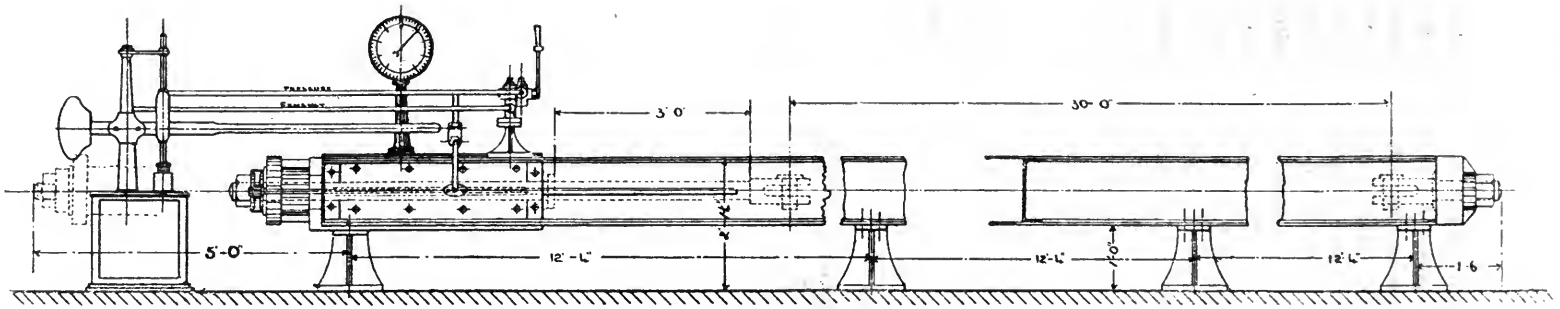
A shadow was cast over the Iron and Steel Institute meeting by the announcement of the death of a popular and respected past-President, Sir Bernhard Samuelson. Sir Bernhard was in his eighty-fifth year. The important part he played in the development of our great iron industry during his long and useful career is a familiar story. It was in the year 1853 that Mr. Samuelson, as he then was, became associated with Mr. Vaughan, and these two men may be considered the pioneers of the Cleveland iron trade. Furnaces were erected at Middlesbrough at a cost of £50,000, and having successfully established the pig iron business, Mr. Samuelson, in 1870, erected the well-known Britannia iron works at Middlesbrough, and went into the finished iron trade.

A complete record of the public services of Sir Bernhard would be no inconsiderable task, but it may be fairly said that Great Britain is indebted to Sir Bernhard Samuelson, perhaps more than to any other man, for valuable industrial statistics showing the position this country occupies with regard to its competitors in Europe and in the United States As long since as 1867 he made a tour of the manufacturing centres of Europe to report on the education of the industrial population at the request of the Vice-President of the Committee of Council, and established a reputation in connection with the subject of technical education, which proved a lasting one. A year later he assisted in a Parliamentary inquiry into the education of British workmen, and at a later date he became a member of the Royal Commissions on Scientific Instruction and Elementary Education. It was no doubt in recognition of his labours in this connection that Sir Bernhard became in 1882 Chairman of the Royal Commission on Technical Instruction, a Commission whose labours extended over several years, and which made an exhaustive and detailed report which has been the standard book of reference, and has formed the basis of subsequent progress made in connection with technical education. This by no means exhausts the public services of the deceased, for he had acted as Chairman of the Parliamentary Committee on Railways in 1873, was Chairman of the Jury in the Mining, Metallurgical and Fuels Section of the Inventions Exhibition in 1885, and a member of the 1888 Parliamentary Committee which investigated the working of the Education Acts. He was also Chairman of a Committee which inquired into the working of the Patent Laws, and was a consistent advocate of reform in this direction. He had already acted as President of the Cleveland Ironmasters' Association, and was for some years President of the Agricultural Engineers' Association. He was an old member of the Council of the Iron and Steel Institute, whose presidential chair he occupied for two years, and he took an active part in the work of the Vigilance Committee of the British Iron Trade Association. A Fellowship of the Royal Society had been bestowed upon him, he was created a Chevalier of the Legion of Honour, and was a member of the Institution of Civil and Mechanical Engineers, while in 1871 he was awarded the Telford Gold Medal for a paper on improvements in the manufacture of iron. He received the well-deserved honour of a baronetcy in 1884.

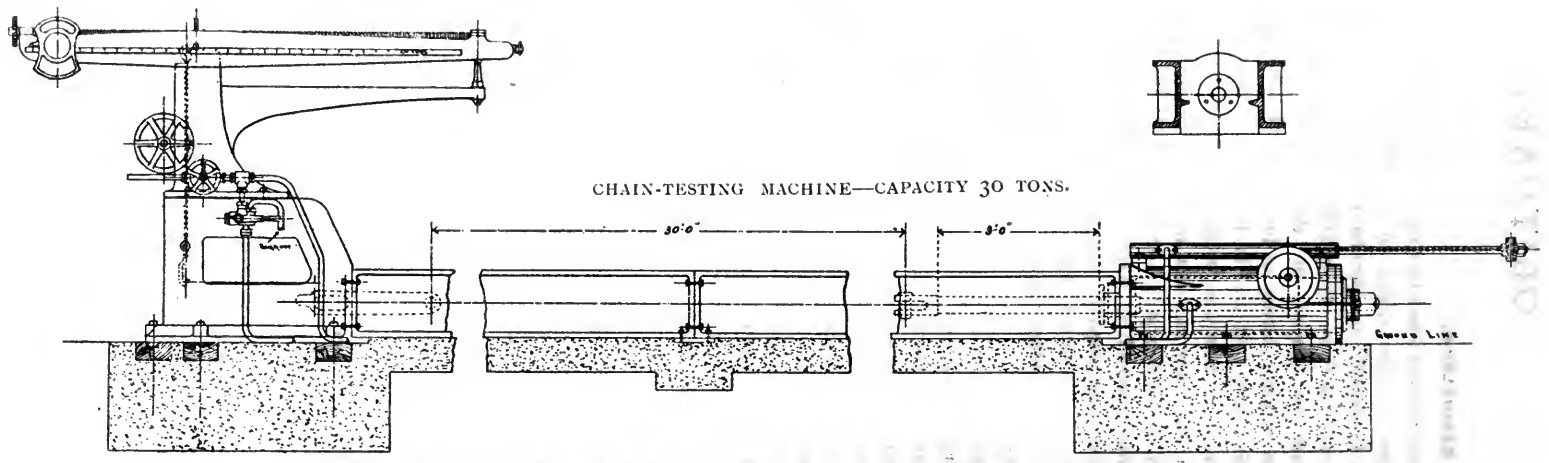
Sir Bernhard's Parliamentary career dated back to 1859, when he became the Liberal member for Banbury, and his connection with the Parliamentary representation of Banbury extended over forty years, a somewhat remarkable instance of loyalty on the part of both member and constituency.

SIR BENJAMIN HINGLEY.

The death is announced of Sir Benjamin Hingley, whose name has long been associated with the South Staffordshire iron trade. Sir Benjamin was the youngest son of the late Mr. Noah Hingley, himself a noted ironmaster, and the architect of the fortunes of the Hingley family. From small beginnings the iron chain and cable works with which the Hingley family are associated, developed until they became among the most important of their kind in England, giving employment to some thousands of hands. As long since as 1877 Sir Benjamin on his father's death, took over the management of the firm, and in addition he assumed public duties in connection with the South Staffordshire iron trade which brought him into prominence and led to his entering Parliament as liberal member for North Worcestershire in 1885, a seat he held for many years. Among his other offices Sir Benjamin had been chairman of the South Staffordshire Ironmasters Association, chairman of the Iron and Steel Trades Wages Board, and he was a member of the Mines Drainage Board and other public bodies connected with the iron and coal industries. As recently as a week ago the deceased had been in London, having been present at the annual meeting of the Iron and Steel Institute, and in spite of his seventy-five years his death was somewhat unexpected.



HYDRAULIC CHAIN-TESTING MACHINE—CAPACITY 50 TONS.



CHAIN-TESTING MACHINE—CAPACITY 30 TONS.

THE FACTORY ACT AND THE TESTING OF CHAINS.

Statutory Rule and Order, No. 617, dated October 24th, 1904, made by the Secretary of State in respect of the processes of loading, unloading, moving, and handling goods in, on, or at any dock, harbour, or canal provides that "All machinery and chains and other gear used in hoisting or lowering in connection with the processes shall have been tested, and shall be periodically examined. All such chains shall be effectually softened by annealing or firing when necessary, and all $\frac{1}{2}$ in. or smaller chains in general use shall be so annealed or fired once every six months." In order that shipbuilders, repairers and smiths, engineers and others may be enabled adequately to comply with the requi ements of the above order, Messrs. Samuel Denison and Son, Ltd., of Leeds, have specially designed two styles of horizontal testing machines for the expeditious testing and proving of chains, slings, blocks, etc. One style gives its indication of load by means of an accurately made hydraulic gauge or dial, and the other by means of a steelyard with a sliding poise weight. The drawings reproduced herewith show both types of machine. Both apply the stress or load to the chains by means of a hydraulic ram and cylinder placed at the end of the machine, and fed from hydraulic power main, or accumulator, or direct from pump—hand or power driven. The capacity varies from 10 tons to 100 tons, and the length from 10 ft. to 90 ft. The machines can be placed flat on the floor for chains only, or may be mounted on legs or stools when blocks as well as chains are to be tested.

Wire Ropes for Winding: Their Strength, and Some Causes of its Reduction.

By J. A. Vaughan and W. Martin Epton.

(*Continued from page* 1020.)

COMPARATIVE TESTS.

Dealing now directly with the subject of the relation that exists between the strength of the whole rope and the aggregate strength of the wires composing it, Table II. shows the results of tests of new ropes in comparison with the tests of their component wires. The 29 tests appearing first in the table were made in the Mines Department Mechanical Laboratory, from samples supplied by nine different manufacturers. The 11 following tests were made in England at two different well-known establishments. The length of the test specimens in the latter cases was 100 in., which is about four times the length of the specimens in the other tests.

From Table II. it will be seen that the tension tests conducted by the writers show a drop in efficiency, for the wire "laid up" in the rope, of from 3·65 per cent. to 17·4 per cent.

The writers freely admit that the results of their tests up to the present are not conclusive as to the deductions that should be made on account of "laid-up" efficiency in ropes of different sizes and of different constructions. They merely state at present that a general 10 per cent. deduction appears reasonable.

Table III. shows the results of some tests carried out in the State University Laboratory, California, on ropes of varying grade of about $\frac{5}{8}$ in. diameter. Here may be seen a drop in efficiency of about 10 per cent. The length of the specimens tested in these cases was 12 inches.

CAUSES OF DETERIORATION.

The deterioration of a winding rope may take either any one or all of the three following forms:—

(1) Decrease in the sectional area of the wires;

(2) "Fatigue," or change of state of the steel, *i.e.*, loss of certain desirable qnalities, such as ductility, originally possessed by the material;

(3) Discontinuity of the wires due to their breaking.

Regarding (1) this may be caused by frictional wear or corrosion, and it may not be confined only to the outer surfaces of the rope and strands.

Frictional wear is of course a necessary corollary to the working life of the rope. External friction is caused by contact with the drum and with other layers of rope on the drum, by contact with the pithead sheave, and by contact with any other guiding or diverting sheaves or rollers met with in the trip.

Circumstances that increase its external wear are the following:—

Sheaves, or guide rollers too heavy, their inertia causing chafing of the rope at every alteration of speed;

Winding of the rope on the drum in several layers, especially so if badly coiled;

Jerky running of the winding engine, *e.g.*, stopping or starting too rapdily;

Guide rollers or sheaves not working freely, worn unequally, or out of alignment;

Insufficient number of guide rollers in an incline or compound shaft, allowing the rope to foul the foot or hanging wall;

Flapping of the rope in a vertical shaft;

Angular friction caused by lateral deviation of rope, or obliquity of direction of rope, between pithead sheave and drum;

Bad bearing in tread of sheave.

Referring to the last-mentioned cause, it is very necessary in the case of a new rope of altered size or greatly different construction to the rope preceding it, that the tread of the sheave should be turned up to suit the new rope. The same course should also be followed if the sheave is changed.

EXTERNAL LUBRICATION.

Continual lubrication of the winding rope would, of course, diminish the wear, but the expense of the

TABLE II.

No. of Test	Diameter of Rope	Construction of Strand	Size of Wires			Quality of Steel	Breaking Load of Outside Wires. (Laboratory Test.)	Breaking Load of Inside Wires. (Laboratory Test.)	Breaking Load of Rope from Maker's Certificate	Breaking Load of whole Rope. (Laboratory Test.)	Aggregate Strength of Wires. (Laboratory Test.)	Percentage Loss of Strength in "Laid-up" Wires	Breaking Stress of Material. Tons per sq. in. (Laboratory Test.)	Breaking Stress of Material. Tons per sq. in. (Maker's Certificate.)	Remarks.
1	2	3	4			5	6	7	8	9	10	11	12	13	
	in.		in	in	in		lbs.	lbs.	tons	tons.	tons.	per cent	tons.	tons.	
159	$\frac{5}{8}$	5/1	·080			Patent	1,031·47			14·3	15·47	7·6	102·6		Soft core wire
8	$1\frac{1}{8}$	6/1	·122	·122		Improved patent crucible	2,095·8		42·56	40·32	44·01	8·4	89·6	80·0	Hard core wire
12	$1\frac{1}{8}$	6/1	·123	·123		Plough	2,540·09			42·4	48·1	11·9	106·8	117 to 123	Three strands had a soft core of one wire, and three strands had a cable core of fine wire
9	1	6/1	·109	·109			1,838·35		32·0	32·7	35·7	8·4	98·5		Core wires partly hard and partly soft
153	1	6/1	·109	109		Special plough	2,475·82		45·5	41·74	44·56	6·33	132·6		Soft core wire
155	1	6/1	·109	·108		Crucible	2,108·49		38·0	38·0	41·1	7·5	113·0		Core wires partly hard and partly soft
13	$\frac{7}{8}$	6/1	·099	·099			1,424·88			28·6	29·92	4·4	92·5		Hard core wire
10	$\frac{7}{8}$	6/1	·098	·098		Best plough	1,735·1		38·92	33·28	36·43	8·6	115·0	123	do.
156	$\frac{7}{8}$	6/1	·098	100		Plough	2,016·66		37·5	32·7	36·3	9·9	133·0		Soft core wire
145	$\frac{7}{8}$	6/1	·083	·083			1,478·2			26·58	31·04	14·1	136·6		Hard core wire
157	$\frac{7}{8}$	6/1	·082	·079		Special patent	1,120·0			19·19	21·8	12·0	106·0		Core wires partly hard and partly soft
35	$\frac{7}{8}$	6/1	·072	·072			786·1			11·13	16·5	14·4	96·5		Hard core wire
104	$\frac{7}{8}$	7/4/1	·088	·049	·034	Improved patent	1,298·78	387·9	25·7	26·38	*29·15	9·5	106·7 102·8		Hard core wire. * Calculated from breaking load of strands
119	$1\frac{1}{8}$	7/5/1	·114	·057	·017	Improved plough	2,460·6	631·75	55·4	54·9	61·19	10·3	120·5	123	Soft core wire
151	$1\frac{1}{8}$	7/5/1	·110	·056	·040	Special patent	1,926·92	484·88	18·0	46·0	47·74	3·6	101·3 98·4		do.
87	$1\frac{1}{8}$	7/5/1	·112	·056	·039		2,432·2	606·0 253·5	60·08	53·4	60·16	11·3	123·0		do.
136	1	7/5/1	·101	·052	·040	Best plough	2,007·21	544·0 286·0	48·25	45·11	51·17	11·9	125·0 128·0		Hard core wire
135	1	7/5/1	·101	·052	·040	do	2,005·64	491·5 341·6	48·5	45·38	50·51	10·2	125·0 115·7		do.
154	1	7/5/1	·100	·052	·041	Plough	2,159·9	511·3	48·9	47·68	53·03	10·1	137·5 120·3		Soft core wire
150	$1\frac{1}{8}$	8/6/1	·101	·057	·057	Special plough	1,647·19	517·94	43·0	44·13	48·86	9·7	102·8 101·4		do.
152	$1\frac{1}{8}$	8/6/1	·103	·057	·055	do	2,283·89	591·4	59·3	56·6	65·46	13·5	137·1 115·8		do.
86	$1\frac{1}{8}$	8/6/1	·102	·059	·059		2,039·38	552·0 314·0	52·15	53·33	58·88	9·4	124·0 100·0		do.
58	$1\frac{1}{8}$	10/5/1	·090	·075	057		1,771·0	1,168·12 573·04		59·81	72·37	17·4	139·0 132·0		Hard core wire
147	$1\frac{1}{8}$	19	·073			Special improved patent plough	1,184·65		63·8	54·66	63·97	14·6	141·5	135 to 145	Soft core wire
113	$1\frac{1}{8}$	19	·073				1,134·47			57·68	64·66	10·8	135·0		Hard core wire
114	$1\frac{1}{8}$	19	·073				1,142·4			54·6	65·11	16·1	136·5		do.
42	$1\frac{1}{8}$	19	·073				1,105·0		61·0	53·74	62·98	14·7	132·0	134	do.
92	$1\frac{1}{8}$	19	·073				1,137·5		63·84	55·0	61·42	10·4	135·0	135 to 145	Soft core wire
158	$\frac{3}{4}$	19	·048			Special patent	336·9			18·42	19·2	4·1	93·0		Hard core wire
	$1\frac{1}{8}$	19	·083			Extra plough	1,761·25		78·34		95·11	17·6	162·77		Soft core wire
	$1\frac{1}{8}$	19	·090			Plough	1,832·89		92·23		98·97	6·8	144·05		do.
	$\frac{3}{4}$	7	·085			Improved plough	1,526·1		26·94		27·47	1·9	134·47		do.
	·716	6/1	·0814	·084		Crucible	1,044·0		18·12		18·79	3·6	100·3		do.
	·716	6/1	·0812			do.	1,045·0		20·00		21·94	8·8	100·9		Hard core wire
	·716	12	·0463			do.	377·0		12·64		13·57	6·8	111·9		do.
	·716	15/9	·0384	·038		do	249·0		16·87		17·93	5·9	108·3		do.
	·716	12/6/1	·0481	·0487	·049	do.	381·0		16·99		20·57	17·4	104·0		Soft core wire
	·756	6/1	·0871	·088		Special improved plough	1,487·0		25·51		26·77	4·7	124·8		do.
	·756	6/1	·0873			do do.	1,476·0		28·59		31·00	7·8	123·3		Hard core wire
	$1\frac{1}{8}$	8/6/1	·1046	·0561	·058	Crucible	1,567·0	488·0	42·41		46·39	8·6	91·2 98·7		Soft core wire

NOTE.—In calculating the strength of the whole rope from the breaking load of the wires (column 10). the strength of the core wire is omitted when manufactured of soft material

undertaking is sufficient to prevent such practice being adopted, apart from the practical difficulties connected with the step. It may be noted, however, that haulage ropes are in some cases kept well greased by their running over a sheave pulley working in a box containing lubricant for the purpose, and the life of the rope is increased.

On these fields it is the custom to treat the winding rope, about once a week, with a composition which is supposed not only to lubricate the rope but also to preserve it from corrosive action. The best dressing for the rope would be one of neutral, or possibly alkaline, reaction, and of such consistency that it will not only remain on the rope under all working conditions but will also penetrate to the interior.

CAUSES OF INTERNAL FRICTION.

Internal frictional wear is caused by the pressure and rubbing of one wire against another, either in the same strand or in an adjacent one. Every alteration of stress in a winding rope tends to alter the spirality of the strands in the rope, and that of the wires in the strand so that, in ordinary working there must always be friction between adjoining wires. This action may be more severe, and its effects more marked, on account of the following causes :—

The want of internal lubricant ;

Badly trimmed joints of the wire. Brazed joints should be filed or ground smooth and reduced down to the same size as the wire ;

Bending of the rope round a curve of small radius ;

The core wires of strands being of high grade steel, or of special section with cutting edges such as Δ.

The two latter effects are more severe in ropes with long "lays" of wires or strands, as also in some ropes of compound construction in which the wires are not of the same grade steel.

INTERNAL LUBRICATION.

Regarding the matter of internal lubrication, it is the general custom in the manufacture of the rope to soak the hemp core with some lubricating composition, but there appears a great deal of difference between the ropes of different manufacturers in this respect, in the matter of the thoroughness of the greasing.

In some cases, owing to process of manufacture. the hemp core provides practically a reservoir of lubricant, while in others it may be likened to a dry sponge ever ready to absorb moisture. When a new rope is put on it should be thoroughly treated with the composition before the mine water gets a chance to wet it. This course may not be absolutely necessary in all cases owing to the manufacturer's foresight, but it is a prudent course to adopt.

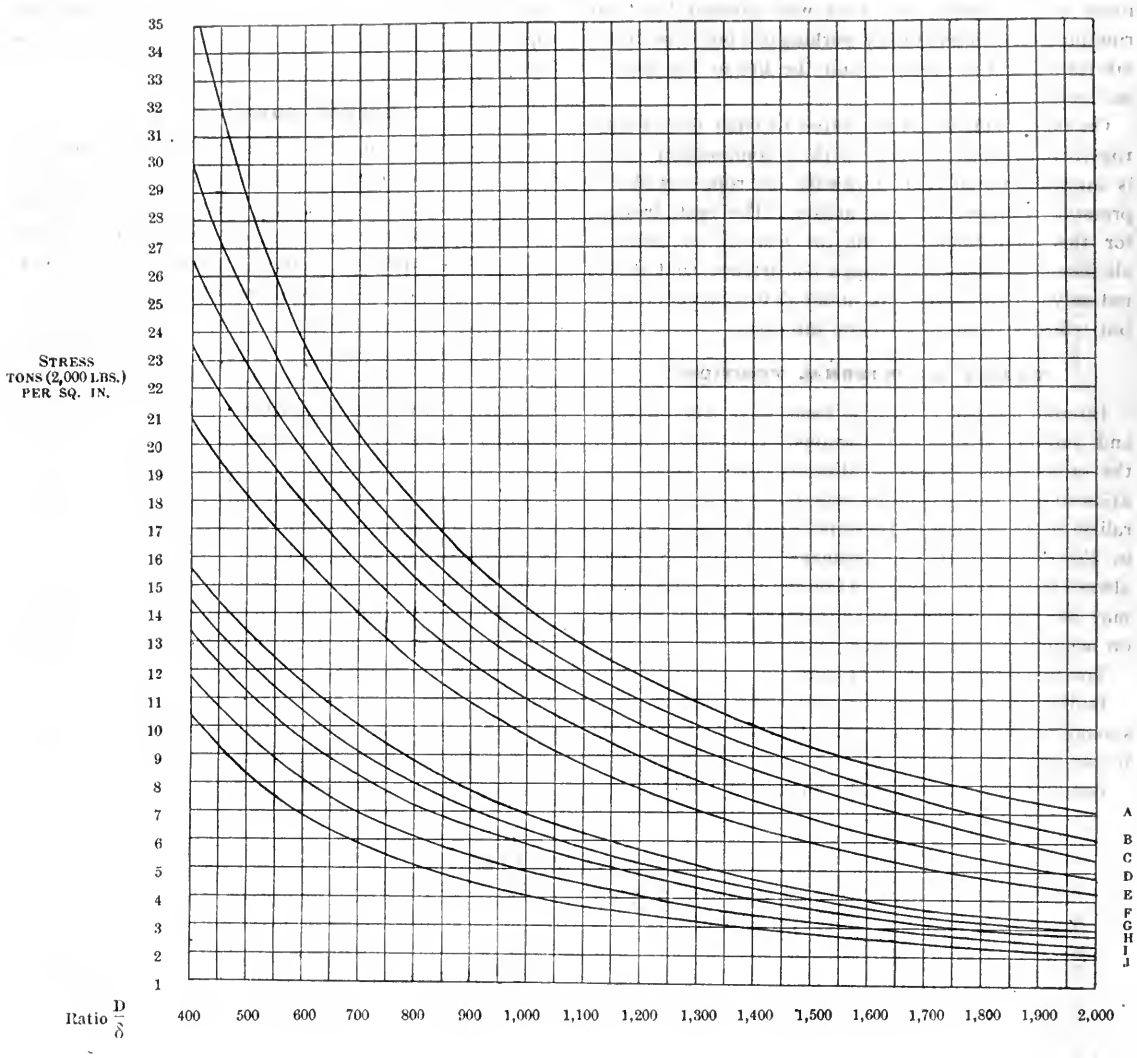
In Mr. Biggart's experiments is was found that in the working life of ropes, under certain conditions, the destruction of the rope was more due to internal cutting friction than from any external wear. The application of oil or other lubricant capable of permeating the rope was found to materially mitigate this internal wear. For example, one rope $1\frac{3}{4}$ in. circumference, ran over a $10\frac{1}{2}$ in. diameter pulley 16,000 times unoiled

TABLE III.

Diameter of Rope.	Construction of Strand.	Diameter of Wire.	Quality of Steel.		Mean Breaking Load of Wires.	Breaking Load of Whole Rope.			Loss of Strength of Wires by their being in the form of Rope.
			Trade Name.	Ultimate Stress.		Calculated from Breaking Load of Wires.	Calculated from Breaking Load of Strands.	As Tested.	
in.		in.		tons.	lbs.	tons.	tons.	tons.	per cent.
$\frac{5}{8}$	12/6/1	·045	Basic	53·13	169	9·63	8·50	8·53	11
$\frac{5}{8}$	12/6/1	·047	Crucible	89·63	311	17·72	15·50	14·68	17
$\frac{5}{8}$	12/6/1	·040	Basic galvanised	40·19	101	5·75	5·47	5·12	11
$\frac{5}{8}$	6/1	·072	Crucible	101·44	826	17·36	14·97	15·65	10
$\frac{5}{8}$	6/1	·070	Basic galvanised	40·02	308	6·47	6·35	6·09	6
$\frac{5}{8}$	6/1	·072	Basic	59·68	486	10·21	9·58	9·45	7

DIAGRAM I.

Bending Stress in Wires of New Ropes.



	Wire. (Straight.)	Lock Coil Ropes.	Wire Spiral Ropes.			Round Ropes with Hemp Cores in Strands, including Strand Spiral Ropes.				Cables.
			Flat Ropes with Hemp Cores in Strands.							
		Flat Ropes with Wire Cores in Strands.	Round Ropes with Wire Cores in Strands.			Normal.	Flexible.		Very flexible.	
			Normal.	Flexible.	Very flexible.					
	A	B	C	D	E	F	G	H	I	J
Tons per sq. in.	E = 14,220	E = 11,600	E = 9,950	E = 8,540	E = 7,300	E = 5,120	E = 4,660	E = 4,200	E = 3,640	E = 3,070
	E_1 = 14,220	E_1 = 12,100	E_1 = 10,650	E_1 = 9,450	E_1 = 8,400	E_1 = 6,150	E_1 = 5,800	E_1 = 5,350	E_1 = 4,740	E_1 = 4,150

and with lubrication 38,700 times; while a similar rope unoiled ran over a 24 in. diameter pulley 74,000 times, and when lubricated 386,000 times.

Decrease in the sectional area of the wire in the rope, as well as the breaking of the wires, may be the result of some accident, such as :—

Derailment of the skip in incline shaft;

Mounting of the rope on the pit-head sheave;

Kinking of the rope during unreeling, or on occasions when the stress is taken off;

Impact with other bodies, falls of rock, etc.;

Burning by electric discharge from fallen cables, or other source.

In the case of any accident such as above mentioned the rope would naturally be carefully examined, and no difficulty would be experienced in locating the damage sustained by it.

PREVENTING CORROSION.

Rusting or corrosion also contributes largely to the wasting away of the substance in the rope.

It is not possible generally to keep winding ropes dry, and mine water very often contains free sulphuric acid and salts, such as ferrous sulphate and ferric sulphate, which accelerate the corrosion which would occur slowly even in their absence, from the presence of water, oxygen and carbonic acid.

In wrought or ingot iron the corrosion rises with the percentage of carbon and this applies to steels with much combined carbon. Rusting is increased by galvanic action as, for instance, tinplate when the tin coating is broken. Similarly with iron railings coated with lead, corrosion occurs just above the junction of the metals. The same applies to copper covered iron, the protection being satisfactory only so long as the coating is perfect. Galvanised stee (with zinc) on the other hand rusts less than steel since zinc is attacked first, but it is very susceptible to chlorides (*e.g.*, sea water), and also will not stand the action of the free acid in some mine waters. The thin coating of zinc on the wires of a winding rope will very soon be worn through at the places where external or internal rubbing occurs.

A galvanic couple may arise from contact of two different kinds of iron and even by lack of homogeneity in one piece of iron, two different varieties causing local galvanic action. Even variations in the proportion of Mn, that is to say the manganese disposed irregularly, may be the cause of local action. Generally speaking, "pitting" effects are due to galvanic action and the extent of the deterioration is local.

It is not left to the persons responsible for the examination of winding ropes to discover the presence of acid or other impurities in mine water causing corrosion, for in shafts where this enemy is present many other evidences force it to the notice of the management. In such cases special attention should be paid to the thorough dressing and examination of the rope. Whether any continuous treatment of the rope with alkaline solution would be effective in preventing the corrosion due to this class of mine water is a subject which may be left in the hands of the chemist.

FATIGUE.

Regarding (2) the deterioration due to "fatigue" or change of state of the steel, it is well-known that the frequent application of a load, well below that producing stress up to the elastic limit, eventually produces "fatigue" in steel. Reversals of the load accelerate this action. The fatigue shows itself by the steel becoming brittle. Whether this is due to an alteration in the arrangement of the molecules of the steel, this changing from the fibrous to the crystalline structure, is a point on which scientists do not agree. Most certainly the wire becomes brittle and behaves as if a structure of the steel had become crystalline.

As to the mechanical causes that lead to this "fatigue" in winding ropes, the stress due to bending is probably the chief of these.

Mr. Biggart's experience went to show that the severity of bending largely determined the life of a rope, and that generally a rope lasted twice as long when only bent in one direction, as against those used under alternate stresses of flexure. It is well known in mining practice that the contra flexure exerted upon the rope that winds on at the lower side of the drum shortens its life in comparison with the top rope. It is also well known that, with proper sizes of sheaves, transmission ropes will last for several years.

The bending of the wires, as laid up in a rope, is less severe than if they were straight, the compound spiral form having the effect of lessening the bending stress.

Diagram 1 shows the bending stress per square inch, in the wires of new ropes of various constructions, according to Hrabak's assessment.

It may be seen from the diagram how unfavourably Hrabak regards ropes that have wire cores in their strands, and also the high bending stresses that he assesses for the wire in flat ropes.

(*To be continued.*)

From a paper read before the Transvaal Institute of Mechanical Engineers.

BRITISH STANDARD SCREW THREADS.

AN interim report on a subject of far-reaching importance—Standard Screw Threads—has just been issued by the Engineering Standards Committee. Owing to the delay which has been found unavoidable in the collation of the valuable information received from manufacturers and users, it has not yet been found practicable to give the committee's final conclusions, but the interim report now issued will be of considerable use, as it deals with the form and pitches of screw threads most suitable for general engineering purposes. The committee responsible for the report included Mr. H. F. Donaldson (chairman), *Eng.-Comm. D. E. Smith, R.N., Eng.-Comm. E. F. Ellis, R.N., Sir William Preece, K.C.B., Col. R. E. B. Crompton, C.B., Col. H. C. L. Holden, R.A., Dr. R. T. Glazebrook, Messrs. G. Blake Oughterson, H. J. Chaney, I.S.O., Henry Lea, Michael Longridge, J. McFarlane Gray, D. Hulme, W. I. Taylor, J. F. Robinson, W. Collingwood, H. A. Ivatt, T. Hurry Riches, A. W. Hutton, J. G. Stewart, E. Grice, A. Sharp, H. I. Brackenbury, O. P. Clements, †A. Le Neve Foster, R. Matthews, C. Salmon, J. E. Storey, and W. Taylor.

The committee recommend that the Whitworth form of thread be adopted on all screws of $\frac{1}{4}$-in. diameter, and above, having either Whitworth or British Standard fine pitches. They believe that the accurate generation of this form of thread can be effected by methods which they hope to deal with in a subsequent report.

In the Whitworth form of thread the angle between the slopes, measured in the axial plane, is 55 deg.; the threads are rounded equally at crests and roots to a radius of ·137329 times the pitch, and therefore the depth of the thread is 0·640327 times the pitch. At the same time the committee's investigations clearly indicated that there is a wide-spread desire for a series of finer pitches to supplement the Whitworth series. To meet this need they have, after careful consideration, prepared a table of fine pitches for screws of $\frac{1}{4}$ in. to 6 in. diameter inclusive, and recommend that the pitches given in Table II., reproduced herewith, be adopted in cases where Whitworth pitches are unsuitable.

For all sizes of screw threads below $\frac{1}{4}$ in. diameter, the committee recommend the adoption of the pitches, sizes, and form of thread recommended by the British Association Small Screw Gauge Committee. Dimensions and particulars of these threads are included in Tables III. and IV. The committee recommend that all screw threads made in accordance with the sizes given in Table I. be known as British standard Whitworth screw threads (B.S.W.); those in Table II. as British standard fine screw threads (B.S.F.); and those in Table III. as British Association screw threads (B.A.). The Committee on Screw Threads and Limit Gauges are at present engaged in considering how best to secure satisfactory interchangeability between male and female serews.

* Retired May 28th, 1904. † Since deceased.

TABLE II.—BRITISH STANDARD FINE SCREW THREADS.

1	2	3	4	5	6	7
Full Diameter.	No. of Threads per Inch.	Pitch.	Standard Depth of Thread.	Effective Diameter.	Core Diameter.	Cross Sectional Area at Bottom of Thread.
Ins.		In.	In.	Ins.	Ins.	Sq. Ins.
$\frac{1}{4}$ (·25)	25	·0400	·0256	·2244	·1988	·0310
$\frac{5}{16}$ (·3125)	22	·0455	·0291	·2834	·2543	·0508
$\frac{3}{8}$ (·375)	20	·0500	·0320	·3430	·3110	·0760
$\frac{7}{16}$ (·4375)	18	·0556	·0356	·4019	·3664	·1054
$\frac{1}{2}$ (·5)	16	·0625	·0400	·4600	·4200	·1385
$\frac{9}{16}$ (·5625)	16	·0625	·0400	·5225	·4825	·1828
$\frac{5}{8}$ (·625)	14	·0714	·0457	·5793	·5335	·2235
$\frac{11}{16}$ (·6875)	14	·0714	·0457	·6418	·5960	·2790
$\frac{3}{4}$ (·75)	12	·0833	·0534	·6966	·6433	·3250
$\frac{13}{16}$ (·8125)	12	·0833	·0534	·7591	·7058	·3913
$\frac{7}{8}$ (·875)	11	·0909	·0582	·8168	·7586	·4520
*$\frac{15}{16}$ (·9375)	11	·0909	·0582	·8793	·8211	·5295
1	10	·1000	·0640	·9360	·8719	·5971
$1\frac{1}{8}$ (1·125)	9	·1111	·0711	1·0539	·9827	·7585
$1\frac{1}{4}$ (1·25)	9	·1111	·0711	1·1789	1·1077	·9637
$1\frac{3}{8}$ (1·375)	8	·1250	·0800	1·2950	1·2149	1·1593
$1\frac{1}{2}$ (1·5)	8	·1250	·0800	1·4200	1·3399	1·4100
$1\frac{5}{8}$ (1·625)	8	·1250	·0800	1·5450	1·4649	1·6854
$1\frac{3}{4}$ (1·75)	7	·1429	·0915	1·6585	1·5670	1·9285
*$1\frac{7}{8}$ (1·875)	7	·1429	·0915	1·7835	1·6920	2·2485
2	7	·1429	·0915	1·9085	1·8170	2·5930
*$2\frac{1}{8}$ (2·125)	7	·1429	·0915	2·0335	1·9420	2·9620
$2\frac{1}{4}$ (2·25)	6	·1667	·1067	2·1433	2·0366	3·2576
*$2\frac{3}{8}$ (2·375)	6	·1667	·1067	2·2683	2·1616	3·6698
$2\frac{1}{2}$ (2·5)	6	·1667	·1067	2·3933	2·2866	4·1065
*$2\frac{5}{8}$ (2·625)	6	·1667	·1067	2·5183	2·4116	4·5677
$2\frac{3}{4}$ (2·75)	6	·1667	·1067	2·6433	2·5366	5·0535
*$2\frac{7}{8}$ (2·875)	6	·1667	·1067	2·7683	2·6616	5·5639
3	5	·2000	·1281	2·8719	2·7439	5·9133
*$3\frac{1}{8}$ (3·125)	5	·2000	·1281	2·9969	2·8689	6·4643
$3\frac{1}{4}$ (3·25)	5	·2000	·1281	3·1219	2·9939	7·0399
*$3\frac{3}{8}$ (3·375)	5	·2000	·1281	3·2469	3·1189	7·6400
$3\frac{1}{2}$ (3·5)	4·5	·2222	·1423	3·3577	3·2154	8·1201
*$3\frac{5}{8}$ (3·625)	4·5	·2222	·1423	3·4827	3·3404	8·7637
$3\frac{3}{4}$ (3·75)	4·5	·2222	·1423	3·6077	3·4654	9·4319
*$3\frac{7}{8}$ (3·875)	4·5	·2222	·1423	3·7327	3·5904	10·1246
4	4·5	·2222	·1423	3·8577	3·7154	10·8418
*$4\frac{1}{8}$ (3·125)	4·5	·2222	·1423	3·9827	3·8404	11·5836
*$4\frac{1}{4}$ (4·25)	4	·2500	·1601	4·0899	3·9298	12·1292
*$4\frac{3}{8}$ (4·375)	4	·2500	·1601	4·2149	4·0548	12·9131
$4\frac{1}{2}$ (4·5)	4	·2500	·1601	4·3399	4·1798	13·7215
*$4\frac{5}{8}$ (4·625)	4	·2500	·1601	4·4649	4·3048	14·5545
*$4\frac{3}{4}$ (4·75)	4	·2500	·1601	4·5899	4·4298	15·4120
*$4\frac{7}{8}$ (4·875)	4	·2500	·1601	4·7149	4·5548	16·2940
5	4	·2500	·1601	4·8399	4·6798	17·2006
*$5\frac{1}{8}$ (5·125)	4	·2500	·1601	4·9649	4·8048	18·1318
*$5\frac{1}{4}$ (5·25)	3·5	·2857	·1830	5·0670	4·8841	18·7352
*$5\frac{3}{8}$ (5·375)	3·5	·2857	·1830	5·1920	5·0091	19·7065
$5\frac{1}{2}$ (5·5)	3·5	·2857	·1830	5·3170	5·1341	20·7023
*$5\frac{5}{8}$ (5·625)	3·5	·2857	·1830	5·4420	5·2591	21·7226
*$5\frac{3}{4}$ (5·75)	3·5	·2857	·1830	5·5670	5·3841	22·7675
*$5\frac{7}{8}$ (5·875)	3·5	·2857	·1830	5·6920	5·5091	23·8370
6	3·5	·2857	·1830	5·8170	5·6341	24·9310

* The Committee recommend that for general use these sizes be dispensed with

OUR WEEKLY BIOGRAPHY.

Mr. BENNETT H. BROUGH, F.G.S., Assoc.R.S.M., F.I.C.

MR. BENNETT H. BROUGH, who this year completes his twenty-first year in the service of the Iron and Steel Institute, having acted as co-editor of the Journal since June, 1884, was born in 1860, and educated successively at the City of London School, the Royal School of Mines, and the Royal Prussian School of Mines at Clausthal. For many years he was Instructor in Mine Surveying at the Royal School of Mines, and resigned that appointment in February, 1893, to become secretary of the Iron and Steel Institute.

Photo, Elliott and Fry.]

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Mr. Brough is the author of a well-known treatise on mine surveying, which is now in its eleventh edition; he has contributed to the technical societies numerous papers dealing with mining and metallurgy, including The Mineral Resources of Hungary; Use of the Magnetic Needle in Exploring for Iron Ore; Tacheometry or Rapid Surveying; Outbursts of Gas in Metalliferous Mines; Cantor Lectures on Mine Surveying; The Use of Cement in Shaft Sinking; Mining at Great Depths; The Mining and Metallurgical Industries of Sweden; Deep Levels in Mining Practice in the United Kingdom; The First Institution of Mining Engineers; Cantor Lectures on The Nature and Yield of Metalliferous Deposits; The Scarcity of Coal; A Medal Struck in Steel; World's Iron Ore Supplies; Cantor Lectures on The Mining of Non-Metallic Minerals, and Metals connected with the Iron Industry. He is also the author of the article on Fuel in Thorpe's Dictionary of Applied Chemistry, and of a report on the Colonial and Foreign Coal Resources prepared for the Royal Commission on Coal Supplies.

In 1885 he acted as juror at the Inventions Exhibition and received a medal for his services, and was awarded a medal for the collection illustrating the economic minerals of Great Britain formed by him at the request of the Royal Commission for the Chicago Exhibition of 1893. He also served on the mining and metallurgical committees of the British sections of the Paris Exhibition of 1889 and of the St. Louis Exhibition of 1904.

Mr. Brough is a Knight of the Swedish Order of Wasa, and a member of the Council of the Institution of Mining Engineers. He has also served on the Councils of the Institute of Chemistry and of the Chemical Society. He has acted as examiner in mining subjects to the University of Glasgow, the University of Wales, the Royal School of Mines and the Camborne Mining School, and has visited many of the mining districts in Europe, the United States, Canada, the West Indies and the Transvaal.

IRON AND STEEL INSTITUTE.

THE ANNUAL MEETING.

(*Continued from page* 1012.)

THE CONTINUOUS STEEL PROCESS IN FIXED FURNACES.

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The continuous process, as carried out in fixed open-hearth furnaces, which have been at work at the Czenstochowa works of B. Hautke for the last two and a half years, has called forth considerable interest in metallurgical circles. The process is based on the idea and the principle of the Talbot process, with the essential difference that it can be carried out in any fixed furnace of not less than 45 tons capacity.

At the Czenstochowa works there is at work a 25-ton furnace. During its first campaign it made 574 charges by the continuous process, and since then has already made over 690 charges, and will, it is hoped, keep at work up to the 1,000 charges.

The chief material required for the continuous process is, of course, pig iron, employed in a molten condition. On this point the conditions under which the furnace has to work have not been specially favourable. The variations in the chemical composition of the pig iron are very considerable, as the following shows : Carbon, up to 3 per cent. ; graphite, up to 3·7 per cent. ; silicon, 0·8 to 1·9 per cent. ; manganese, 0·6 to 1·5 per cent. ; phosphorus, 0·5 to 0·8 per cent. ; sulphur, 0·02 to 0·10 per cent.

These variations have a great influence on the production of the furnace, and in order to lessen them as much as possible the hotter and more graphitic pig-iron is treated with iron ore (Krivoi-Rog ore with about 63 per cent. of iron). There is produced thereby a more or less intense reaction, according to the temperature and according to the composition of the pig iron, which promotes the conversion of graphite into combined carbon, and the oxidation of the silicon and manganese.

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The furnace makes usually three charges in the twenty-four hours, each of 25 tons. When the blast-furnace is working well, and a pig iron with low silicon and manganese is obtainable, four charges can be made.

Statistics show that the yield (reckoned on the metal charged) is 102·7 per cent.; but it must be stated that the daily reports are made up with a certain amount of circumspection, and it may be taken that the average yield is not less than 103½ to 105 per cent. From this one could easily reckon the reduction of the iron from the ore. In the Krivoi-Rog ore there is an average of 63 per cent. of iron ; that is to say, in the whole amount of ore introduced there are 288·6 tons of iron. Since in the pig iron added there are 5 per cent. of foreign bodies, and for the other metals added 5 per cent. of loss can be taken, there has been, if we take the average yield at 104 per cent., 180 tons of iron or 62·3 per cent. reduced. This reduction of iron from the ore in an essentially oxidising apparatus, such as the open-hearth furnace, must be looked upon as a great advantage, and it is scarcely possible in any other refining operation, even in the Talbot furnace, to obtain a greater reduction.

As to the quality of the material produced, it is obvious that special quality steel is more easily made in the furnace itself than in the ladle, but the above method gives results leaving nothing to be wished for when producing a first-class quality of soft ingot iron. Mechanical tests and analyses show that the ingot iron produced by the continuous process leaves nothing to be desired. Experiments have also demonstrated that metal made by the ordinary process and by the continuous process are similar to each other, and make it clear that the former fears as to the metal deoxidised in the ladle being less homogeneous than that produced by the ordinary process were perfectly groundless.

The continuous process can naturally be still further developed, but in any case it has shown, during the last two years of practical work, its capabilities and advantages. These advantages do not consist solely in the continuity of the process itself, but in the longer life of the furnace, the higher production and yield, the lessened fuel consumption, and also in the simplicity of the whole plant and of the whole practice. There may be here and there, some imperfections in connection with it, as is the case with everything new, but these will, it is to be hoped, be overcome with time.

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A paper on this subject was read by Mr. John H. Darby and Mr. George Hatton, of which the following is an abstract :—

Many attempts have been made to accelerate the open-hearth process of steel making, acid or basic, by increasing the size of the furnaces employed, perfecting the machinery for charging the steel-making materials, using molten iron from the blast furnaces, regulating its supply and composition by the use of a mixer, etc., and the object in view has more or less been accomplished. But with all such improvements, in practice it is generally found essential to employ pig metal of special composition, which is not always readily obtained, and may be somewhat costly to manufacture.

The writers hope to show that by the aid of the Bertrand-Thiel process a variety of pig irons may be used, differing in composition, while at the same time the output of steel is kept at its maximum, and the quality of the product uniformly excellent.

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The average temperature of the furnace, looking

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1905.	Number of Furnaces.	Number of Charges.	Composition of Charges.												Production. Good Material.					Consumption of Iron Ore, &c., per Metric Ton of good Steel.					
			Molten Thomas Pig Metal.		Ferro-Manganese.		Ferro-Silicon and Spiegeleisen.		Light and Plate Scrap.		Broken Moulds.		Total.		Per 24 Hours.		Per Cent. of Metals Charged.	Weight of Charge.		Swedish Iron Ore.	Mill Scale.	Lime.	Limestone.	Gas Producer Coal.	Basic Material.
April.			T.	C.	T.	C.	T.	C.	T.	C.	T.	C.	T.	C.	T.	C.		T.	C.	C.	C.	C.	C.	C.	C.
3	2	10	143	19	2	8	1	14	29	18	...	...	177	19	186	2	104·53	18	12	3·74	1·26	1·88	0·86	5·00	1·08
4	2	11	158	1	2	11	1	6	30	6	...	...	192	4	200	17	104·50	18	5	3·48	1·18	1·86	0·86	4·64	1·10
5	2	10	143	4	2	10	1	6	34	18	2	8	184	6	192	10	104·48	19	5	3·58	0·88	1·76	0·84	4·84	1·04
6	2	10	145	4	2	10	2	13	34	12	...	...	184	19	193	6	104·52	19	6	3·40	1·14	1·76	0·82	4·82	1·04
7	2	10	144	12	2	10	4	4	25	18	...	8	177	12	185	12	104·50	18	11	3·98	1.26	1·84	0·82	5·02	1·08
8	2	10	143	15	2	14	1	4	34	4	...	16	182	13	190	19	104·55	19	2	3·36	1·10	1·78	0·84	4·88	1·04
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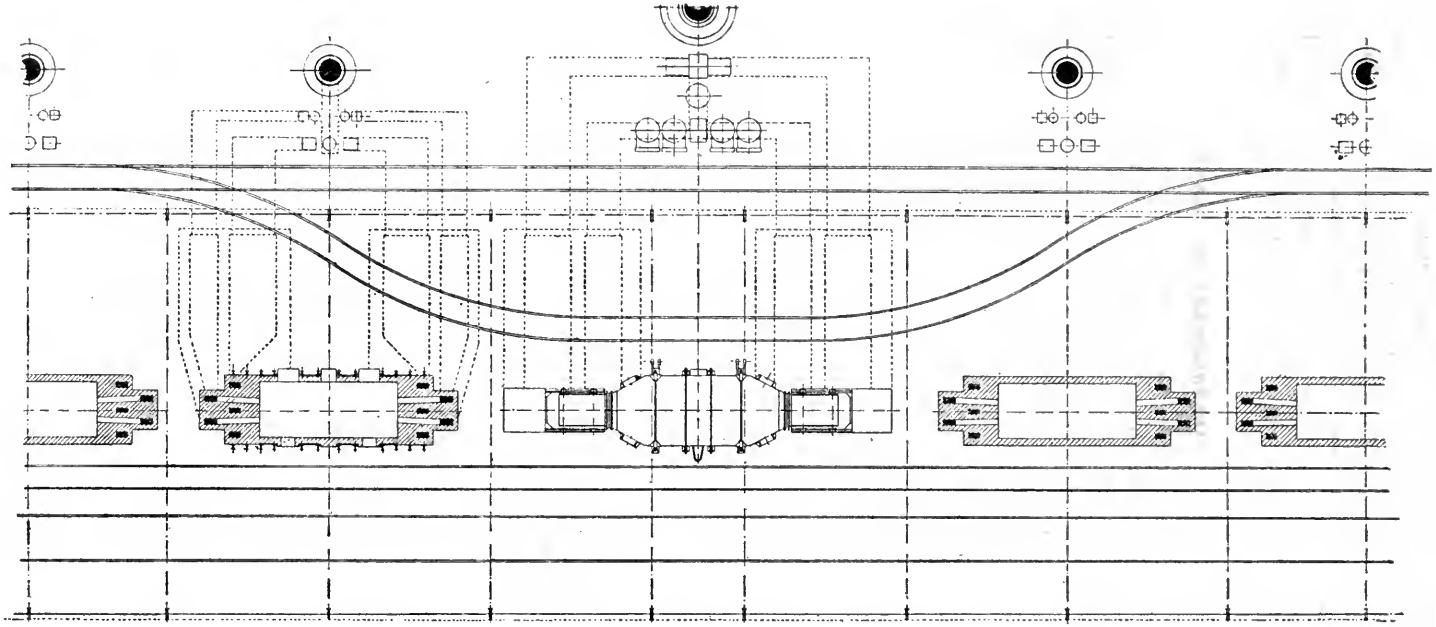


FIG. 1.—General Plan.

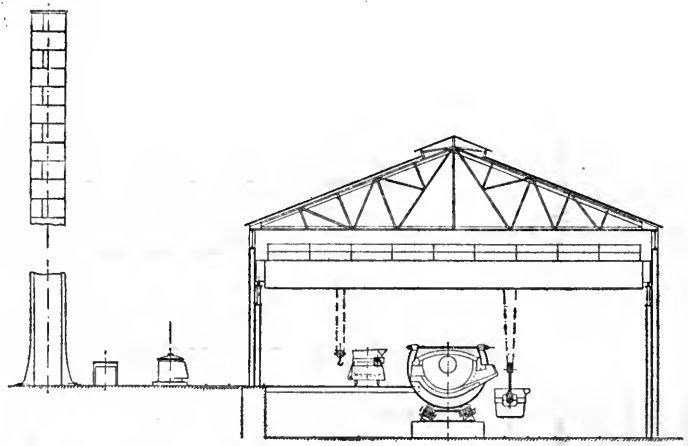


FIG. 2.—Elevation through Tender, showing Crane.

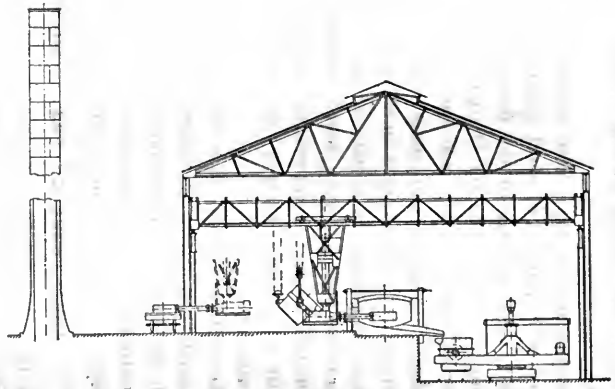


FIG. 3.—Elevation through Open-Hearth Furnace, showing Charger and Locomotive Casting Crane.

THE BERTRAND-THIEL PROCESS.

on to the surface of slag through the central door, was 1,545 deg. C., as shown by the Wanner pyrometer, compared with the secondary furnace in full heat of 1,720 deg. C.

It may be noted that the carbon largely remained, the silicon was almost all eliminated, the sulphur reduced, and 61·5 per cent. of phosphorus removed. Counting the mixer as a primary furnace, three furnaces were engaged, the two secondary furnaces charged with 25 per cent. scrap, working up the output of the mixer with forty-two 20-ton charges between three furnaces, or fourteen charges per week per furnace.

The added ore in the mixer was well exhausted. The speed of working was slower than the first modification of the process tried.

THE LESSONS OF EXPERIENCE.

Average composition of mixer slag :—

	Per cent.
Silica	15·5
Ferric oxide	9·0
Phospheric acid	18·5
Lime..	19·5

The original method of working employed by Bertrand has the advantage of faster working. The second method, although not so expeditious, involves less trouble in transfer, but is trying to the lining of an important furnace like the mixer.

In both the methods described phospheric iron was employed, made with specially low percentages of silicon and sulphur.

It is to be noticed that sulphur was very readily eliminated in the primary furnace, and irons were obtained containing high percentages of sulphur and silicon in order to test the process.

The percentage of sulphur in the finished steel for the secondary furnace did not in any case exceed 0·05 per cent. Pigs with 2 to 2·5 per cent. of silicon are readily treated in the primary furnace, and owing to the short duration of the charge no excessive wear of the lining takes place. The result of experience enables the statement to be made that by partial preliminary refining in ore, furnace pig of almost any ordinary composition can be commercially treated.

IRON ALLOYS AND LIQUID AIR TEMPERATURES.

A paper on this subject was read by the President.

Mr. Hadfield said that as many iron alloys had shown anomalous results in their physical behaviour at ordinary temperatures, it became advisable to ascertain the exact effect of very low temperatures upon such bodies, and, accordingly, a series of tests were carried out on standard iron and iron alloyed with other elements, the specimens being selected from a large collection made by him at the Hecla Works, Sheffield. In the course of the inquiry some 500 specimens have been examined. The bars experimented upon were finished to certain specified dimensions. The bars were then tested whilst immersed in liquid air, 182 deg. C. The results show that with the exception of the nickel-manganese iron alloys, the effect of liquid air temperature is to increase in a remarkable degree the maximum tenacity of iron alloys, whilst in most cases their ductility disappears. These changes take place in the softest wrought-iron, as well as in the various carbon and other steels. Thus the absence or presence of carbon in ordinary carbon steel in which other special elements are not present seems to have but little influence. That there is no error in this statement is proved, independently of the tensile tests, by the fact that several bars of the "S.C.I." and mild steel specimens were submitted to the low temperature test, and tested by hand hammer immediately after immersion. In all cases they exhibited great brittleness, breaking off instantly upon being struck with the hammer; there was an entire absence of ductility.

TOUGHENING EFFECT OF NICKEL UPON IRON.

Further confirmation is obtained by the Brinell hardness ball test. Under this test the "S.C.I." specimens at normal temperature had a hardness number of 90, whereas when tested at about — 182 deg. C. this increased to no less than 266, or about equal to the hardness of 0·80 per cent. carbon steel at normal temperature. This almost seems incredible when it is remembered that the "S.C.I." shows by analysis 99·82 per cent. of iron, and normally has only twenty to twenty-two tons tenacity with 25·30 per cent. elongation. The importance of the discovery of the toughening effect of nickel upon iron at low temperatures will be seen when it is understood that whilst it has been well known that nickel in certain percentages produced important improvements in the qualities and properties of iron and steel alloys, no microscopical or chemical research work has yet proved why this came about.

It seems fairly clear that these experiments go a long way towards offering a satisfactory explanation. It will be noted that the purest iron, as represented by the "S.C.I." containing 99·82 per cent. iron and of specially high quality and purity, becomes

brittle to an extraordinary degree under the influence of the low temperature — 182 deg. C. (test Nos. 95A and 136), whereas nickel itself tested at the same low temperature (test No. 120) has improved rather than deteriorated, not only in tenacity, which iron also does, but in ductility, in which latter quality iron entirely breaks down. If nickel, therefore, is present in an iron alloy containing but little carbon or comparatively low in that element, it acts as a preventive of brittleness, or is a very considerable modifier of that objectionable quality.

DUCTILITY OF NICKEL AT ORDINARY TEMPERATURES.

It may be interesting to state that at ordinary temperatures the toughness or ductility of nickel is no greater than that of iron. For example, in comparative tensile tests, made by the author, of nickel and pure iron, the ductility of iron was greater. The reduction of area in the material generally shows its condition as regards ductility; in the specimens in question the reduction of area in the tensile test bars was nearly 20 per cent. greater for iron in both his "S.C.I." and Arnold's pure iron than in the nickel specimen tested. Iron to a more or less degree, at any rate in manufacturing operations, always seems to be endeavouring to wander out of the "paths" of ductility and toughness; it is constantly endeavouring to become brittle. It will often assume its apparently brittle nature on the slightest provocation, and the metallurgist by his arts is always trying to correct this tendency. As with humanity, there seems to be a law of tendencies, and iron by heredity is constitutionally weak.

It would appear, therefore, that iron, a cheap and convenient metal itself, must be permeated by some element that will mask or modify its properties. Until comparatively recently carbon was the only element known to modify the properties of iron; but, as will be seen from this research, this element, where great toughness is required, only helps to make matters worse. Fortunately for iron, however, its close companion, nickel, singularly enough in the same group, comes along and acts as a friend in keeping it—iron—up to the mark, and preventing it from wandering out of the narrow road of metallurgical rectitude, that is, of toughness or ductility. Exactly why this should be so cannot easily be explained, but this is the fact. Possibly some interpenetration of the atomic mass causes a change which cannot as yet be deduced by any known chemical investigations. Iron, too, is a very crystalline metal, whereas nickel appears to be much more amorphous; it is possible, therefore, that nickel tends to prevent iron crystallising in this manner, or prevents it cooling in such large or dangerous types of crystals.

The influence of nickel is simply marvellous in certain of the alloy specimens, for example in test No. 114, which is an alloy of iron, carbon 1·18 per cent., nickel 24·30 per cent., and manganese 6·05 per cent. Here the ductility is extraordinary, not only at ordinary but at low temperatures, probably the highest known for any iron alloy.

There is still present in this alloy 68 per cent. of iron, yet the tendency of the latter metal to wander into the paths of brittleness is not only entirely checked at the liquid air temperature—and this brittleness as shown so clearly in this research, occurs to an extraordinary extent in pure iron cooled to — 182 deg. C.—but the elongation or ductility, already so great, is considerably increased, namely, from 60 per cent. to 67½ per cent. There is also an increase of tenacity in both cases, namely, a rise of from 10 to 38 per cent. Thus the nickel present—as these results cannot apparently be ascribed to any other cause—enables the bar under this high tension and at 182 deg. C. to remain far more ductile than the very best of ductile iron of one-third the tenacity.

NICKEL-MANGANESE IRON.

Although the action of nickel has been specially referred to, it must not be overlooked that in this alloy there is also present 6 per cent. of manganese, which, in its ordinary combination with iron, that is with no nickel present, would confer intense brittleness upon the iron and render it more brittle than if not present. This treble combination of nickel-manganese with iron appears to reverse all the known laws of iron alloys. M. Osmond's theory as regards these iron-nickel-manganese alloys is that manganese acts here in the nature of nickel. He considers that 1 per cent. of manganese is equivalent in its action upon iron to 2 per cent. of nickel. In conclusion, it may be said that the many extraordinary changes brought about in the physical properties of iron and its alloys could not have been deduced from any known laws. Iron in the main is "embrittled" to an extraordinary degree by liquid air temperature, and yet it will be seen that this "hereditary" tendency can be entirely checked in certain of its nickel-iron-manganese combinations. These various changes appear to be certainly not chemical, and it is rather to the physicist we must eventually look for full and correct explanation of the many curious results obtained in this research.

Professor Barrett said that it was very obvious that if there were more manufacturers in this country imbued with the same strong scientific spirit shown by the new President, the industry would more rapidly advance, and they would much more closely approach the condition of our German neighbours, who brought science to almost all their vocations and pursuits. Mr. Hadfield had, he continued, obtained a series of iron alloys freer from disturbing elements than any other person had hitherto obtained. One of the alloys given by Mr. Hadfield was the most remarkable ever given to the world. It had the highest electrical resistance, and the highest thermal resistance of any alloy he had ever examined, or probably which ever existed. This alloy, he thought, might very well prove of extreme practical value in the manufacture of material for such purposes as the lining of cylinders.

Mr. Gledhill (Armstrong, Whitworth and Co.) commented upon the prominence given by the President to nickel steel, and said that material had now become the Government standard, and had been adopted for torpedoes, where there had to be extreme thickness and at the same time a capacity to resist enormous pressure.

THE DRY-AIR BLAST.

Mr. James Gayley, of New York, centributed a supplementary paper to one he read on the "Application of the Dry-Air Blast," when the members recently visited America.

It was to be regretted, the author stated, that the data respecting the use of the dry-air blast, which were presented to the Institute at its meeting in the United States in October, should have been restricted to the period from August 25th to September 9th inclusive, and from September 17th to 30th inclusive. In order to present the paper at all it was found necessary to limit the record of operations to the period above stated. In the discussion of the paper it would appear, from the conclusions of some participating therein, that they have been placed at some disadvantage in considering the economies obtained through the use of the dry-air blast by reason of the data covering such a short period. It was the purpose of the supplementary communication to present in detail the record of operations of the Isabella furnace rom November, 1904, to March, 1905, inclusive, as shown by the furnace records. It had been thought by some that the use of the dry-air blast might be dispensed with in the winter months, when the amount of moisture in the atmosphere was very low. There could scarcely be a month more favourable to the study of the effect of dry-air than that presented in the month of February, 1905, when the average of moisture is 1·19 grains for the daytime and 1·17 grains for the night, with a maximum variation of 0·30 to 2·57 grains of moisture per cubic foot of air. The records for that month showed that the benefits derivable from the use of dry air could be directed in the main to increase of production or to decrease in coke consumption or to both purposes. Notwithstanding the low content of moisture in the normal blast representing conditions rarely obtained in the Pittsburg district, the furnace supplied with dry-blast, made, considering the stops, practically as much iron—with a consumption of coke 433 lb. less per ton of iron—as the furnace supplied with normal blast. As the summer season approaches the product of the furnace using normal blast would steadily decrease and the fuel increase, while the output of the furnace supplied with dry air would continue practically uniform.

THE LATEST FIGURES.

Mr. Windsor Richards said he had taken a great interest in the question in connection with the furnaces at Low Moor. They had always at this time of the year to put on more coal, and when the weather got hotter, to put on more coal still. With the great and rapid variation in the moisture in the air in this country, it was quite impossible to burden the furnaces, and, therefore, it was very desirable to adopt some means of eliminating the moisture from the air. While in America they were told the enormous advantages of dry air both as regarded working and output, but he was afraid at that time many of them had "a Thomas Didymus kind of feeling" about it. Since that time, however, they had come round to a different view, and he was only sorry that Mr. Gayley, who, as they knew, was one of the best blast-furnace managers in this or any other country, could not be present to answer the questions of the members. That morning, however, he had received a cable from that gentleman showing that even better results had been obtained than those mentioned in the paper. The cable ran: "Isabella record nine days May dry blast shows increase over normal blast, 70 tons daily. Made with 400 lb. less coke. Product Bessemer iron and ore mixture, same both furnaces. Atmosphere increasing in humidity, advantages will increase." These, they would all admit, were really wonderful figures, when they applied to them the economies which must take place during a year's time and he quite agreed with one of the speakers that in reducing the moisture to a small and constant amount, Mr. Gayley's invention might well prove to be the

most important advance in the metallurgy of pig-iron since Neilson's introduction of the hot blast in 1828.

The discussion was continued by Mr. A. K. Reese, of Llandaff, Mr. William Whitwell (Saltburn-by-the Sea), and others, Mr. Whitwell stating that there had no doubt been astounding results achieved in America, owing to the application of dry-air blast, systematic charging, or some secret not yet possessed in this country.

SULPHUR IN COKE AND ITS BEHAVIOUR IN THE BLAST FURNACES.

Professors F. Wüst and P. Wolff contributed a paper on this subject of which the following is an abstract: Notwithstanding the many chemical and thermal influences to which the sulphur in coke is exposed during the process of coking in ovens, the finished coke still retains an extremely high percentage of this deleterious element. In fact it may be said, speaking figuratively, that the sulphur clings to the coke with a peculiar pertinacity. It is therefore necessary to determine whether the sulphur content of the coke is to any extent influenced by the action at different temperatures of the blast-furnace gases on the coke. In order to do this there have to be taken into account, besides the oxygen, the hydrogen, vapour. nitrogen, carbon, monoxide, and carbon dioxide. For purposes of investigation a blast-furnace coke from the Westphalian Ruhr district was selected, in which the proportion of total sulphur contained was 1·406 per cent.

The determination of the combustible sulphur in the coke is made by burning finely powdered coke in a current of oxygen. The mean of ten careful tests yielded 1.09 per cent. of combustible sulphur. The experiments were carried out in an electric-resistance furnace of the Heræus type, the length of time the heat was maintained being five hours in each case, exclusive of the period required for heating up and cooling down.

RESULTS OF EXPERIMENTS.

In the hydrogen experiments the volatilised sulphur varied from 7·59 per cent. to 5·117 per cent. of the total sulphur contents, the temperatures ranging from 500 to 1,000 degrees C. With steam, under similar conditions, the volatilised sulphur rose from 12·84 per cent. at 500 degrees C. to 54·34 per cent. at 1,000 degrees C. With nitrogen it ranged between 2·41 to 17·35 per cent., with C O from 12·80 to 38·32 per cent., and with C O2 from 6·7 to 59·24 per cent.

It appeared desirable to investigate more closely the conditions under which the sulphur of the coke, which was volatilised by the blast-furnace gases, had been absorbed by the charge; that is to say, by the ores and limestone.

Table I. shows that even at low temperatures a considerable absorption of the sulphur contents of the gases takes place. The results in Table II. present the absorption of sulphur in a very different light. At 250 degrees and 500 degrees the amount of sulphur taken up is very small, but from 600 degrees it rises rapidly until at 1,000 degrees almost the whole of the sulphur has been taken up.

TABLE I.—*Ferric Oxide.*

Temperature of the Ignited Coke.	Loss on Ignition.	Sulphur driven off from Coke.	Volatilised Sulphur in Percentages of the total Sulphur Content.	Temperature of the Ignited Ferric Oxide.	Sulphur taken up by Ferric Oxide, relative to original weight of Coke.	Sulphur taken up by Ferric Oxide in Percentages of total Volatilised Sulphur.
Deg. Cent.	Per Cent.	Per Cent.	Per Cent.	Deg. Cent.	Per Cent.	Per Cent.
1000 to 1050	23·52	0·6232	44·32	250	0·3307	53·06
	23·78	0·6933	49·31	500	0·4439	64·02
	24·66	0·6632	47·17	600	0·4539	68·33
	24·51	0·8250	58·67	800	0·5741	69·58
	25·16	0·8211	58·39	900	0·5585	68·02
	30·43	0·7543	53·64	1000	0·4564	62·66

TABLE III.—*Ferric Oxide and Carbonate of Lime.*

Temperature of the ignited Coke.	Loss on ignition of the Coke.	Sulphur driven off from Coke.	Volatilised Sulphur in Percentages of the total Sulphur Content.	Sulphur taken up by Ferric Oxide.	Sulphur taken up by Ferric Oxide in Percentages of total Volatilised Sulphur.	Sulphur taken up by the $CaCO_3$.	Sulphur taken up by the $CaCO_3$ in Percentages of the total Volatilised Sulphur.	Sulphur taken up by $Fe_2O_3+CaCO_3$.	Sulphur taken up by $Fe_2O_3+CaCO_3$ in Percentages of the total Volatilised Sulphur.	Temperature at which the $Fe_2O_3+CaCO_3$ was ignited.
Deg. Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Deg. Cent.
1000 to 1050	23·09	0·5837	41·51	0·3312	56·81	...	...	0·3313	56·81	250
	20·97	0·4683	33·31	0·2783	59·44	...	...	0·2783	59·44	500
	21·67	0·4382	31·17	0·2599	59·32	0·011	2·34	0·2709	61·66	600
	24·98	0·5694	40·49	0·1041	18·28	0·2954	45·78	0·2995	64·06	800
	22·30	0·4396	31·27	0·1804	41·03	0·1890	43·00	0·3694	84·03	900
	22·87	0·4847	34·47	...	...	...	...	0·4878	100·64	1000

TABLE II.—*Carbonate of Lime.*

Temperature of the Ignited Coke.	Loss on Ignition of the Coke.	Sulphur driven off from Coke.	Volatilised Sulphur in Percentages of the total Sulphur Content.	Temperature of the ignited $CaCO_3$	Sulphur taken up by the $CaCO_3$ relative to original weight of Coke per Cent.	Sulphur taken up by the $CaCO_3$ in Percentages of the total Volatilised Sulphur.
Deg. Cent.	Per Cent.	Per Cent.	Per Cent.	Deg. Cent.	Per Cent.	Per Cent.
1050 to 1050	29·76	0·8681	61·74	250	0·0890	10·26
	28·99	0·8428	59·94	500	0·1406	16·68
	30·56	0·7519	53·47	600	0·3558	47·05
	22·36	0·5998	42·66	800	0·3888	68·08
	25·71	0·5753	40·91	900	0·4933	85·74
	25·77	0·5705	40·57	1060	0·5239	91·83

A series of experiments was then undertaken in order to determine the behaviour of the ferric oxide and carbonate of lime together in the presence of the blast-furnace gases containing sulphur. The results of the series are set forth in Table III.

THE CLEANING OF BLAST FURNACE GAS.

Mr. Axel Sahlin contributed a paper on this subject, of which the following is an abstract: The rapid development of the gas-motor during the last five years has given new value and importance to the gas escaping from the blast furnace, previously often described as waste gas. This "waste gas" has now become a potential source of energy, which, rightly used and husbanded, should, together with the gas from the coke ovens supplying the blast furnaces, suffice for the carrying out of the entire series of converting and finishing processes which transform the ore into marketable steel products. Successful efforts to remove the dust from the gas used in the gas engine have, in a practical manner, demonstrated how wasteful and imperfect have been our previous methods of utilising the valuable blast-furnace gas. Until the appearance of the gas engine at the blast furnace plant the dust problem was, as a general rule, dealt with in a different manner by each of the three large iron-producing countries. In England, in at least 90 per cent. of the blast-furnace works, the dust in the gas was disregarded. Since the discovery of the Mesabi mines American blast-furnace engineers have been compelled to use a burden containing from 50 to 100 per cent. of dust-fine ore, and the question of cleaning the gas became one of imperative importance. The generally adopted American dust-catcher consists of a wide, unobstructed chamber, through which the gas passes and in which its velocity is greatly retarded. The bottom of the dust-catcher is built as a hopper, closed at its lowest point by a door or valve, through which the dust from time to time is removed by gravity.

It required the appearance of the gas engine to compel improvements in these methods, and to stop, at least partly, the waste which was complacently permitted to go on from year to year.

We have now learned and realised that the whole of the gas escaping from the blast furnace should be utilised for subsequent refining and finishing processes, and that, before being so used, it should be thoroughly cleaned.

A general outline of the cleaning plant for the entire volume of gas from one blast furnace in shown in fig. 4.

The gas leaves the furnace through four uptakes placed at 90 deg. angle. These join into one downcomer, which delivers the gas in tangential direction into a clyindrical dust-catcher. From the top of the dust-catcher the gas passes through one of two mushroom valves. The valve nearest to the stoves connects the dust-catcher direct with the gas main, and is opened only in case of repairs to the gas-cleaning plant. The second valve connects the dust-catcher with a water-seal, from which the gas flows into the Sahlin gas-cleaner described above. From this gas-cleaner it reaches a ventilator which delivers the now sufficiently clean and cooled gas into the bottom of a dryer. By closing the drain-pipe and admitting water, this scrubber or dryer may be changed into a second water-seal, effectively isolating the cleaner.

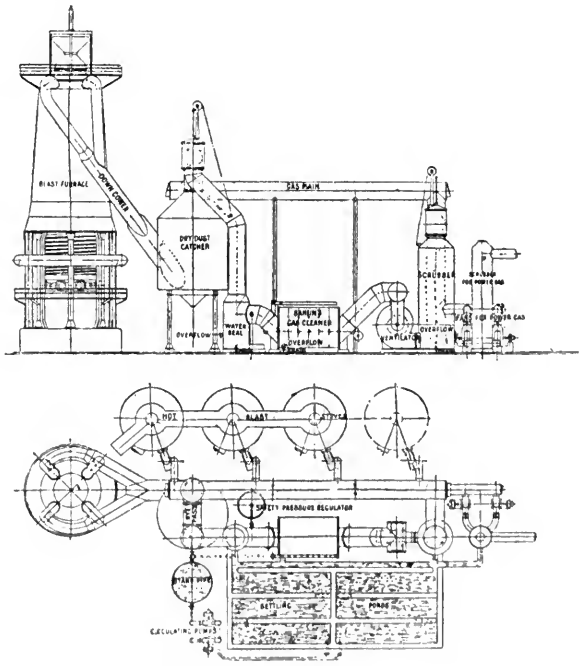


FIG 4.—GENERAL ARRANGEMENT OF CLEANING PLANT.

Gas for power plant is drawn from the clean gas-main, and is passed through one of two electrically driven fans, sprayed with water, and discharging into a second smaller dryer, whence the gas now, practically speaking, dust free, is sent to the engines. The size of this plant depends on the quantity of gas required for power purposes. A fan cleaning 10,000 cubic feet per minute, and using 8,000 gallons of spraying water per hour, requires about 65 h.p., and will supply gas engines of from 5,000 to 6,000 h,p. The pumping of spraying water will require about 3 h.p. additional.

DANGERS OF BLAST FURNACE GAS.

A paper on the prevention of asphyxiation accidents to blast-furnace workmen had been prepared by Mr. H. B. Thwaite.

With the rapidly increasing application of blast furnace gas to power purposes (said Mr. Thwaite), there had arisen a need for the adoption of measures intended for the protection of the workmen, who might be subjected to its influence, inasmuch as its chief and most valuable thermal constituent, carbon monoxide, was highly toxic. Amongst other precautions, Mr. Thwaite suggested that, where practicable, all gas flues and gas pipes should be placed above the ground, and, if possible, above the breathing level. If underground, gas flues should be built of blue bricks, set in cement. Gas flue manholes should be equipped with lids that would secure the maintenance of perfect gas tightness. The ground surface below the building should be covered with a layer of cement concrete, and an open air space should be formed between the cement surface and the flooring boards of the building. Forced ventilation should be the principle adopted for all occupied buildings in iron and steel works. The gas engine exhaust pipes should terminate at a considerable altitude above the works floor. The time allowed to be occupied in gas producer poking operations for individual men should be limited to three minutes. If power gas pipes had to be placed underground, they should be placed in grate-covered open trenches, and the pipe flanges should be planed.

RESEARCH WORK.

HIGH-SPEED TOOL STEELS.

In the light of Dr. Carpenter's experiments the rationale of the advantageous presence of tungsten and molybdenum in high-speed tool steels appears fairly evident. The action of either of these elements consists in hindering, under certain conditions, and in altogether preventing, under suitably chosen conditions, changes in iron carbon alloys which would have for their result the softening of the material and its consequent unfitness for tool steel use. By suitable heat treatment it is possible to arrest the softening process at any desired stage, and thus obtain an alloy of any desired hardness.

The metallographical results of the investigation are extremely interesting. They show that in spite of comparatively large percentages—up to 17 or 18 per cent.—of special elements, iron and carbon still remain as the all-important factors in determining the types of structure of high-speed tool steels. Except that the polyhedral or "austentic" type of structure has never been obtained alone in a pure carbon steel, the types of the high-speed tool steels might all be obtained from pure iron carbon steels by appropriate thermal treatment. The austentic structure appears to be that of the nose of the tool in actual use.

MAGNETIC AND ELECTRIC PROPERTIES.

An investigation was made by Mr. Gunnar Dillner and Mr. A. F. Enström with the object of studying the influence of chemical composition and of manufacturing methods on the materials used in electrical engineering work, more especially in dynamo and transformer construction.

It is a well-known fact that the energy loss in the core of an armature or of a transformer is due to magnetic hysteresis and to eddy or Foucault currents, the eddy current loss being directly proportionate to the electric conductivity of the steel. It is well known, too, that, generally speaking, when the hysteresis loss is small, the material being "soft," the electric conductivity is considerable, and *vice versa*. It is, of course, desirable that both of them should be small at the same time. It is, moreover, a desideratum that the permeability should be good. For cast steel and steel plates used in pole-pieces, high magnetic induction-values and good permeability as regards common saturation, are most important factors, while, on the other hand, the magnetism not being reversed, the hysteresis properties of the material are of less account. Yet the electric conductivity of the pole material is of interest as regards the eddy currents produced by the variations in magnetism from the slotted armatures generally used.

The researches have been carried out at the testing institution of the Royal Technical University of Stockholm. Samples of commercial steel sheet and steel castings were received from ten Swedish iron works in all.

The results of the experiments confirm the belief that an increase of the carbon percentage implies a corresponding increase of the coercive force and also

of the hysteresis energy loss, and it is obvious that a small amount of carbon is favourable in sheets used in armature cores and transformers. In cast steel a high percentage of carbon increases the electric resistance. An increase of silicon has been found to be accompanied by a quite noticeable increase of the coercive force and of the hysteresis energy loss, whilst the maximum induction does not seem to be influenced to any noteworthy extent. The conclusions to be drawn will be that any addition of this element in making the steel ought, as a rule, to be avoided in case of sheet material. As to the influence of a similar increment of silicon in cast steel, on the contrary, it appears that the results have proved to be anything but unsatisfactory. An addition of aluminium improves sheet material which is to be used for constructing dynamos. As regards cast steel, it must be agreed that the usefulness of aluminium in cast steel is questionable, to say the least.

TROOSTITE AND HEAT TREATMENT AND FATIGUE OF STEEL.

Mr. F. Rogers reported on researches in connection with troostite and heat treatment and fatigue of steel. The experiments do not show the exact state of the carbon in troostite, but there appears to be little room for doubt that it does contain some carbon. Troostite is possibly not of uniform composition, but its several recognised properties may perhaps be more completely explained by regarding it as a mixture, fairly intimate, but not so much so, as is solution of ferrite or cementite with a solid solution of the two. In the case of medium carbon steels the troostite would probably consist of such a mixture of ferrite and solid solution. Its existence in high carbon steels is probable but not fully accepted. The research in connection with heat treatment and fatigue of steel leads to the following conclusions. As to endurance under fatigue although there is an approximate general correspondence with tensile tests, yet irregularities are too great to be overlooked. The principal causes of such irregularities in dynamic testing are heterogeneity of the material; concentration of stress due to rapidly varying section; the fact that the stresses are produced by bending as distinguished from pure tension and compression. Apart from great heterogeneity the results obtained from normal and annealed samples will be comparative as regards any error under this head. Elastic limit has been the most deeply affected of all the mechanical properties recorded. This fact is highly significant, particularly in regard to current inquiry as to the cause of brittleness produced by overheating. When taken in conjunction with the observed great increase in Young's Modulus, it is at once evident that overheating reduces the resilience of steel enormously. The impossibility has been demonstrated of restoring by heat treatment alone a steel which has been fatigued beyond a certain limit.

THE ANNUAL DINNER.

The annual dinner was held on Friday evening last, at the Hotel Cecil, Mr. R. A. Hadfield (president) in the chair.

Amongst those present were the Swedish and Norwegian Minister, the Duke of Norfolk, Mr. Andrew Carnegie (past president), the Lord Mayor of Sheffield, Sir William White, Sir Howard Vincent, M.P., Sir E. J. Reed, M.P., Sir J. J. Jenkins, Sir Joseph Lawrence, M.P., Sir W. Lloyd Wise, Sir James Davies, Mr. T. A. Brassey, Major-General D. D. T. O'Callaghan, Colonel C. F. Hadden, Colonel Herbert Hughes, Captain J. R. Jellicoe, Major-General F. T Lloyd, Major O. C. Wolley-Dod, Commander C. M. de Bartolome, Captain M. Diaz, Mr. J. Fletcher Moulton, M.P., the Mayor of Cardiff, Colonel F. H. Armstrong, Colonel F. B. Buist, Lieut.-Colonel R. H. Mahon, Lieut.-Colonel S. B. von Donop, Mr. Batty Langley, M.P., Mr. Arthur Keen, the Marquis de Berriz, Mr. E. Grant Burls, Mr. A. Dowd, Mr. W. Whitwell (past president), Mr. E. Windsor Richards, Mr. A. T. Tannett Walker, Mr. H. F. Donaldson, (chief superintendent Ordnance Factories), Mr. Jas Riley (vice-president), Mr. E. P. Martin (president of the Institute of Mechanical Engineers), Mr. Maurice Fitzmaurice (chief engineer L.C.C.), Mr. W. H. Bleckley (hon. treasurer), Mr. G. J. Snelus (vice-president), Mr. J. E. Stead, Mr. Alexander Siemens. Mr. W. McDermot, Mr. G. Hall (Master Cutler of Sheffield), Mr. William Frecheville (President Institution of Mining and Metallurgy), Mr. J. M. Gledhill, Mr. George Ainsworth, and Mr. Bennett S. Brough (secretary).

The loyal and patriotic toasts having been duly honoured, the president called upon Mr. Andrew Carnegie to propose the toast of "The Guests," and at the same time to present the gold medal won by Dr. Carpenter, of the National Physical Laboratory, and the silver medal gained jointly by Messrs. Dillner and Enstrom, of Stockholm.

Mr. Carnegie, in presenting the medals, alluded to the hereditary genius of Dr. Carpenter, whose great great-grandfather had placed the iron world under an immense debt of gratitude as the result of his invention of puddling. In handing the medals to the Swedish recipients, he paid a compliment to the "classic home of iron," and reminded those

present that of the 19 nationalities other than British composing the Institute, Sweden had by far and away the largest number of members. Mr. Carnegie also said that they had special interest in Norway and Sweden, as it was to those countries that English manufacturers no doubt would have to look for their supply of ironstone in the future.

DUKE OF NORFOLK PROPOSES "THE INSTITUTE."

The Duke of Norfolk proposed the "Iron and Steel Institute." He said it was not very necessary to pledge themselves to the health of an Institute which could gather together so many members and so many friends as were present that evening. Neither was it necessary to pledge themselves to the future growth of a body which had grown in 20 years in membership from 800 to 2,000. As they had heard, too, some nineteen different countries had contributed to that membership, and when he pointed out that they took their president from one side of the Atlantic and then the other, they would see how widely based and well-grounded the Institute was. But whether it was necessary or not, it was a pleasure to drink the health of a body which was doing so much for the progress and the tone of the industry, and for the well-being of our own and other countries. He was especially proud to couple with the toast the name of a Sheffield gentleman, who was, he believed, the youngest president the Institute had ever had. Sheffield, too, contributed more recruits to the Institute than any other city.

Mr. Hadfield, in his reply, said he was particularly pleased to have the testimony of the high Government officials present as to the work which those engaged in iron and steel were doing. The Swedish Minister had himself paid tribute to the cosmopolitan spirit with which that work was being carried on. He reminded them that Sheffield was the place of meeting chosen for the autumn session, in September, and promised that everyone should have a most hearty and cordial welcome on the occasion.

OPENINGS FOR TRADE ABROAD.

Ottoman Empire.

A concession for ninety-nine year has been granted to Mr. Gavin Gilchrist, an English merchant, for mining bitumen and asphalt near the villages of Harba and Soular, sandjak of Lattakia, vilayet of Beirut. The area to be mined amounts to about 640 acres. Machinery and tools used in the preliminary work, which are of foreign importation (from without the Turkish Empire), will, in first instance, be exempted from import duty.

The Turkish Minister of Public Works invites tenders for the supply of three iron bridges of 20 m. span f.o.b. Smyrna. Firms desirous of tendering should apply to the Special Commission in session at the Ministry of Public Works, Constantinople, or to the vilayet of Smyrna, for plans and particulars.

Russia.

The British Commercial Agent in this country forwards intelligence to the effect that a special commission assembled at Khabarovsk (Eastern Siberia), are considering an application for the organisation of a share company for the purpose of the construction of the Amour Railway. The sum necessary for the realisation of the project is estimated by the initiators at 177,000,000 roubles. The agent remarks that this would be the railway from Sretensk, the present branch terminus of the Siberian line in that direction, to Blagovestchensk, and Khabarovsk, along the course of the Shilka and Amour, the original line it was proposed to construct till the well-known agreement with China afforded Russia a shorter cut to the Far East.

Belgium.

Tenders which will be opened on June 28th are invited by "Société Nationale des Chemins de Fer Vicinaux," for the construction of a railway between Dalhem and Fouron-le-Comte, at the estimated cost of about £9,710. A deposit of £960 is required to qualify any tender. Tenders, in sealed envelopes, should be addressed to the General Manager of the Company, at 14, Rue de la Science, Brussels, where specifications, plans, etc., may be inspected after May 24th. A copy of the specifications may be obtained on payment of one franc.

Spain.

A recent communication from the British Consul at Bilbao reports that dealers and agents in machinery complained of the very slack trade done in 1904. There were no new industries of importance initiated, and the demand was nil. Machinery in general is imported from abroad, but small engines, valves, tools, etc., are chiefly made in the country. The demand for agricultural machinery continues to increase, farmers becoming convinced of its advantages and buying willingly notwithstanding its greater cost. Agricultural machinery and implements come principally from the United States and France, but winnowers and milling machinery from the United Kingdom.

THE BUILDING TRADES EXHIBITION.

(*Continued from page* 1016.)

ARTHUR KOPPEL.

One of the features of the exhibition was the Koppel hydroleum engine, which was run on a specially laid track in the minor hall. The latest form of locomotive of this type is shown in fig. 1. The hydroleum steam generator consists of a patent water-tube boiler, with horse-shoe shaped tubes, fired by the hydroleum patent system of liquid fuel firing. The liquid fuel, which consists of the cheapest forms of hydro-carbon oils, such as Texas fuel oil, kerosine, water gas tar, and the like, is conducted under steam pressure to the combustion chamber or fire-box of the boiler, by a patent hydroleum feeder. There is an opening in the boiler front, in the position of the usual furnace door, and into this opening a structure of refractory material is inserted. The hydroleum feeder projects into this structure, and upon admitting steam from the boiler to the feeder, turning on the oil tap, and applying a temporary flame, combustion ensues, rapidly raising the structure of the refractory material to incandescence. When this stage is reached, combustion continues on this incandescent mass until the working pressure of the boiler is obtained, whereupon the steam pressure in the feeder is automatically decreased by the action of a cut-off sufficient to maintain the boiler working pressure. An ingenious device is employed to raise initial steam for the feeder when the boiler is cold, therefore the whole firing arrangement is self-contained. The hydroleum system can be applied equally well to railway locomotives, road tractors, launches, and stationary boilers. In cases where coal is dear or difficult to obtain, the hydroleum locomotive, even for continuous runs, is said to be cheaper in working cost than ordinary coal fuel locomotives, and even where coal is cheap, it is more economical to use hydroleum locomotives for intermittent work, such as shunting in goods yards and factories, contractors' purposes, mining work, on sugar and tea estates. During stoppages, the oil supply can, it is claimed, by simply turning a tap, be reduced to a tiny jet just sufficient to keep the combustion chamber hot, full working pressure being obtained whenever required in a few minutes.

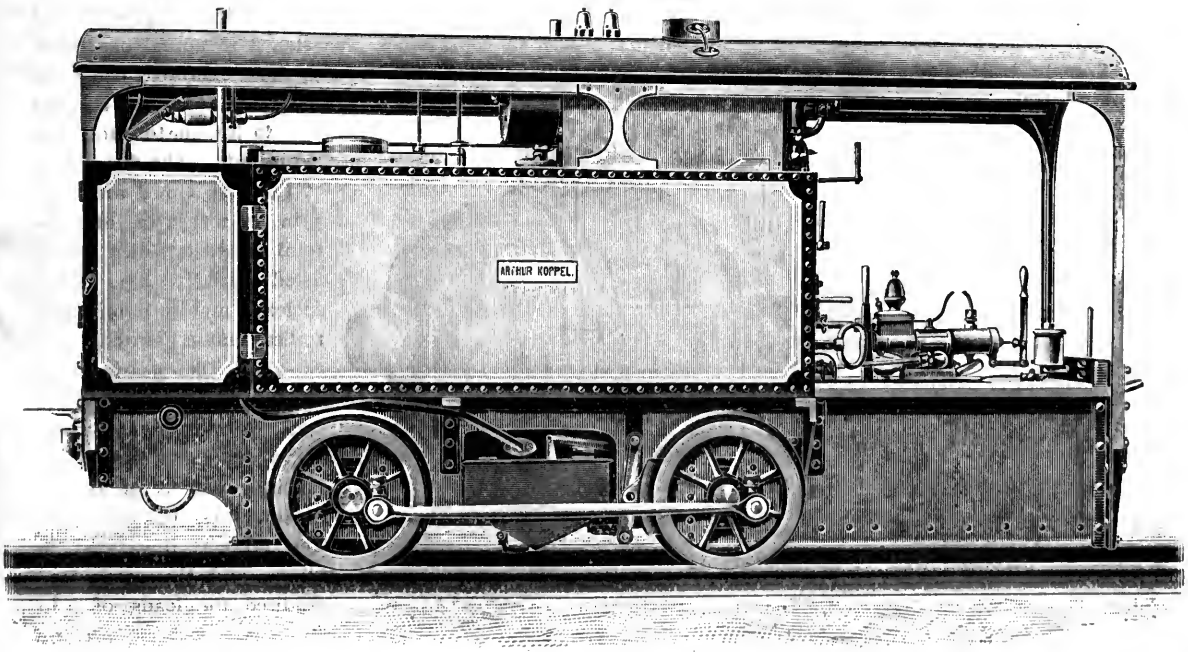


FIG. 1. HYDROLEUM LOCOMOTIVE.

HEENAN AND FROUDE, LTD.

The refuse destructors of this firm are now in operation in many parts of the country, and we illustrate one of their three-cell plants.

The furnace grates are fed from enclosed hoppers. The cells receive assistance from each other, and the gases from each grate are deflected on to each adjacent grate in turn and travel along an undulating course over the whole range of grates—which may consist of any convenient number. The gases then travel the combustion chamber and next through the boiler—which may be a water-tube, Lancashire, or any type of boiler desired. Immediately the gases leave the boiler they pass through an air-heater or regenerator for heating the air for the forced draught; here the heat is partly abstracted from the waste gases to the extent of about 400 deg. F.

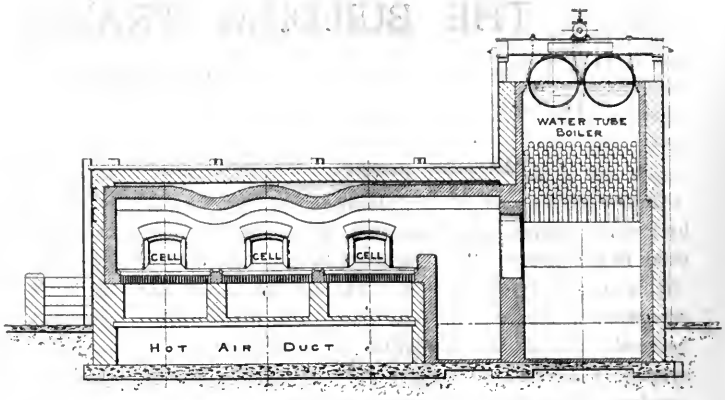


FIG. 2. HEENAN REFUSE DESTRUCTOR — 3 CELL PLANT —

The forced draught is generated by means of a Heenan centrifugal fan driven by enclosed engines, electric or other motors, and arranged so as to thoroughly ventilate the building by extracting the air from the clinkering and tipping floors, and thereby keeping the whole building cool and fresh.

The air is then heated in passing through the regenerator and distributed in the furnaces with the view of ensuring the maximum heat of combustion. The draught is claimed to be under immediate and simple control.

An important feature of this system is the exclusion of inrushes of cold air when the doors are opened for clinkering and charging, etc. Further, the necessity for drying the refuse on "drying hearths" is obviated by using hot dry air.

Official tests quoted show that the plants erected have worked at high efficiency, and the firm hold the bronze medal of the Sanitary Institute, which is claimed as the highest award for this class of exhibit.

"HARMAN" ELECTRIC HOIST.

This new type of hoist, specially designed for the need of contractors, was shown in actual operation. It is made in various sizes, those exhibited being one designed to lift 8 cwt. 80 ft. per minute, and a larger size to lift one ton 100 feet per minute. The dimensions of the first-named are 4 ft. 3 in. by 2 ft. 3 in., and the total weight is 7 cwt. It is fitted with 3-h.p., semi-enclosed motor, liquid controller, main switch, and cut-outs. The gearing is of worm type, fitted with mild steel worm and gun-metal worm wheel and ball-thrust bearings, and is of British manufacture through-out. The hoist is illustrated in fig. 2, and they are standardised for loads of 2 to 30 cwt., and for lifting speeds of 25 to 150 feet per minute.

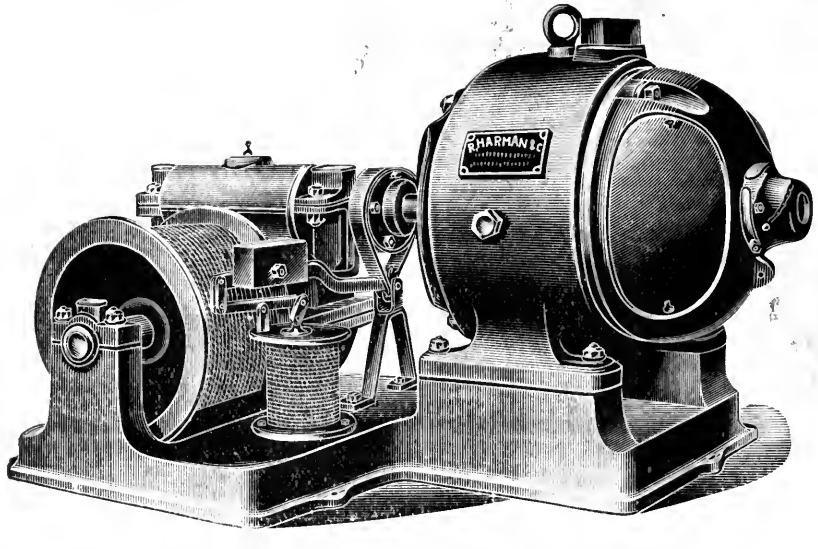


FIG 3. HARMAN ELECTRIC HOIST.

R. BECKER AND CO.

We illustrate on this page types of Kiessling's wood-working machinery, shown by this firm. Fig. 4 shows the firm's combined planing, jointing, moulding, and thicknessing machine. Its construction is easily seen from the illustration. Its alteration to suit one or the other kind of work is said to be a quick and simple process, although as a rule combined machines are not a success. The cutter-block is of best forged steel, provided with grooves on four sides, so that in fixing the moulding cutters the planing irons need not be removed. The upper tables are accurately planed, mounted on inclines, and can be adjusted independently. The lower table is secure and accurately constructed, and can be arranged for a thickness of wood up to 7 in. Before and behind the cutter blocks are elastically working pressure bars, which are claimed to ensure excellent work even with the thinnest wood. The feed of the wood is done by two rollers, of which the one before the cutter block is grooved; the wood is automatically led through the machine without requiring pushing. When the machine is used for thicknessing, the upper tables sliding on the frame are to be drawn out somewhat and the machine is ready for work. In preparing mouldings with a profile of not more than 1½ in. the upper or under table of the machine can be used, *i.e.*, the moulding can be done by hand or automatically, and it depends on the kind of profile, which way is to be preferred.

In fig. 5 the Kiessling circular saw bench, with rising and falling table, is illustrated. The machine

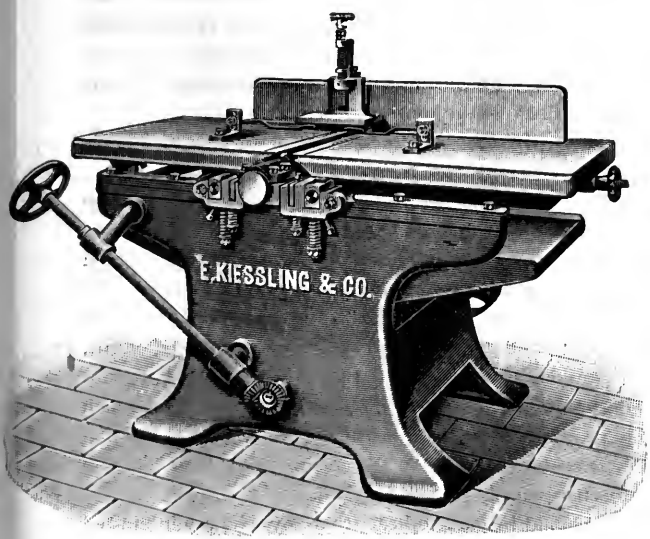


FIG. 4. COMBINED PLANING, JOINTING, MOULDING, AND THICKNESSING MACHINE.

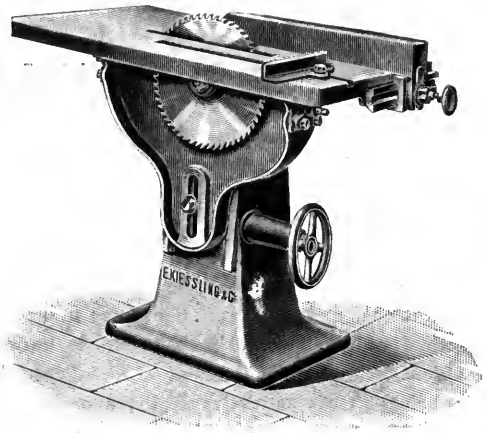


FIG. 5. CIRCULAR SAW BENCH.
With rising, falling, canting and sliding table.

is designed for the use of cabinet makers, builders, and pattern makers. A strong cast-iron stand carries the table, which moves up and down in truly planed prismatic lines. The saw spindle itself is fixed to the stand, well bedded in heavy gun-metal bearings of the latest type, with self-acting ring lubrication The table is hinged on one side and can be lifted up for filling the bearings with oil. It has a large gap for changing the blades and for taking in a cutter block if desired. A parallel fence for ripping and bevel cutting, with fine screw adjustment, is fitted to the table and can be swung back, thus clearing the table for cross cutting. Another fence, which slides in a dovetail groove in front of the saw is supplied with the machine for cross and mitre cutting. Fast and loose pulleys, with Stauffer lubricator and belt-shifter, are fitted to the spindle. If desired, the table can be had with a slide in front of the saw.

PIPE THREADS.

An Engineering Standards report, forwarded by Mr. Leslie S. Robertson (secretary) covers Threads for Iron or Steel Pipes and Tubes.

In order to secure uniformity with the committee's decisions in other directions, it is recommended that the Whitworth form of thread be adopted on all pipe threads for iron and steel tubes manufactured in accordance with the table which accompanies the report.

After very careful consideration as to the advisability of employing the Sellers thread on iron or steel tubes and couplers, the committee came to the conclusion that the arguments brought forward in favour of this form of thread have been insufficient to justify them in recommending its adoption for this class of work.

SHIPBUILDING NOTES.

THERE was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on Monday, the 8th inst., the steel screw trawler *Janus*, the principal dimensions being 123 ft. 6 in. by 22 ft. by 11 ft. 6 in. depth of hold. The vessel has been built to the order of the Orient Steam Fishing Company, Ltd., of Grimsby, and is being fitted with powerful triple-expansion engines by Messrs. Chas. D. Holmes and Co., of Hull. She is replete with all the latest improvements for this class of vessel.

On Tuesday, the 2nd inst., the launch took place from the shipbuilding yard of Messrs. R. Williamson and Son, Workington, of the steel screw steamer *Stock Force*, built to the order of a Liverpool firm of shipowners. Her principal dimensions are: Length, 163 ft. 9 in.; breadth, 26 ft. 6 in.; depth moulded, 13 ft. 2 in., and she is designed to carry 730 tons deadweight on Lloyd's freeboard. The vessel is built to the highest class at Lloyd's, and will be propelled by triple-expansion engines having cylinders 14 in., 22½ in., and 37 in. diameter, with a stroke of 27 in., steam being supplied by a cylindrical steel boiler 13 ft. 6 in. diameter by 10 ft. long, working at a pressure of 160 lb.

On Monday, May 8th, Messrs. Osbourne, Graham and Co., launched from their yard at Hylton, Sunderland, a steel screw steamer, built to the order of a Rostock firm. The vessel is built to pass Lloyd's highest class, and is of the single-deck type, having short poop, bridge and forecastle. She carries 2,400 tons of cargo on a moderate draft. Cellular double bottom is fitted throughout for water ballast, also in the after peak. As the vessel left the ways she was named *Henry Fürst* by Miss Ethel Harper, daughter of the senior partner in the firm of H. G. Harper and Co., London. After the launch the vessel was taken to Messrs. Geo. Clark, Ltd., for her engines, which have cylinders 19 in., 30 in., 50 in., by 36 in. stroke, and will be driven by two large boilers built to German law. During construction the hull and machinery have been built under the supervision of Messrs. Flannery, Baggallay and Johnson, of London, whose representatives, Messrs. Johnson and George, were amongst those present.

On Friday, the 5th inst., Messrs. Ropner and Son, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions: Length, 337 ft.; breadth, 48 ft.; depth, 28 ft. 5 in. The vessel has been built to the order of Messrs. Ropner and Co., West Hartlepool, and is fitted with the builders' patent improved trunk deck. The vessel has double bottom for water ballast on the cellular principle, also in the fore and after peak tanks. The deadweight carrying capacity will be about 6,000 tons on Lloyd's summer freeboard. The vessel will be fully equipped with an up-to-date outfit. The engines will be of the triple-expansion type, of about 1,400 i.h.p., supplied by Messrs. Blair and Co., Ltd., steam being supplied by two main boilers at a working pressure of 180 lb. per square inch. Mrs. Helen Chambers, of Barnsley, gave the vessel the name of *Brookby*.

CORRESPONDENCE.

9, Zenobia Mansions, London, W.,
May 10th, 1905.

To the Editor of PAGE'S WEEKLY.

SIR,—Permit me to call the attention of those of your readers who are inventors to a Bill which is before Parliament, and which, if it passes, will prevent them availing themselves of expert engineering, electrical, chemical, or other similar assistance in preparing their applications for patents.

They will thus be forced to obtain this assistance through Patent Agents, at an additional expense.

An attempt to pass a similar Bill was made by the Chartered Institute of Patent Agents some years ago, but it was withdrawn after it had been considered by a committee who, in their report, stated very decisively their opinion that an inventor should not be compelled to employ any particular class of agent, or any agent at all, and that it would be most undesirable to create a monopoly in such matters, which is precisely what this present Bill is seeking to do.

Inventors should ask the members for their districts to energetically oppose the Bill.

I should be glad to hear from any who are interested in the matter.

I am, your obedient servant,

G. CROSSLEY.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Keighley.—The Electricity Committee invite tenders for superheaters. Mr. Alfred Lister, Borough Treasurer, Town Hall ... ... Last Day. May 20

Colchester.—Laying of 6-in. to 10-in. cast-iron mains and other works for the Corporation. Mr. C. E. Bland, Waterworks Superintendent, Town Hall ... ... May 22

Newton Abbot.—Construction of a reservoir to contain 10,000 gallons, and for providing and laying about 1,210 yards of 3-in. cast-iron water-mains, with the necessary valves, hydrants, etc., for the Newton Abbot Rural District Council. Mr. Samuel Segar, Union Street, Newton Abbot ... ... May 24

Aldeburgh.—Supplying, erecting, setting to work, and maintaining in good order for three months at the new well, near Aldeburgh Hall Farm. of two "Hornsby-Ackroyd" cheap fuel oil engines, two "Hayward-Tyler" Universal pattern pumps, with all necessary gearing, shafting, pipes, valves, and other fittings, for the Corporation. Particulars of Mr. J. C. Gordon, Aldeburgh, or Messrs. James Mansergh and Sons, 5, Victoria Street, Westminster ... ... May 24

London, N.E.—For the Hackney Borough Council, an artesian well and air-lift pumping plant. Mr. Robert Hammond, M.I.C.E., consulting engineer to the Council, 64, Victoria Street, Westminster, S.W. ... ... May 25

Kettering.—Supply, delivery, and erection of Nernst lamps, posts, etc., for street-lighting within their district, for the Kettering Urban District Council. Mr. John Bond, clerk, Council Office, Kettering ... May 29

Bury.—Two steel Lancashire boilers, 30 ft. by 8 ft., for the Guardians. To Mr. A. Hopkinson, of Agur-street, Bury ... ... May 29

Dublin.—Supply of two four-wheeled coupled passenger engines and three six-wheeled coupled goods engines, for the Great Northern Railway Company (Ireland). Mr. T. Morrison, secretary, Amiens Street Terminus, Dublin ... ... May 29

Great Western Railway.—Supply of about 213 tons of steel bridge girders and other steel and iron work of British manufacture for the Great Western Railway Company. The Engineer, Paddington Station... ... ... May 30

Glasgow.—Supply, delivery, and erection of the alternative equipment of the machinery buildings of the Glasgow main drainage works, for the Corporation; including both steam and gas installations and steam installation with stand-by installations worked with town gas. Mr. W. S. Hamilton, Bath Street, Glasgow ... June 1

Mode Wheel (Manchester).—Construction of a new dry dock and auxiliary works on the westerly side of the Manchester Ship Canal Docks at Mode Wheel, near Manchester, for the Manchester Ship Canal Pontoons and Dry Docks Company, Ltd. Offices of the Company at Mode Wheel, or of the engineer, Mr. W. H. Hunter, M.Inst.C.E., 41, Spring Gardens, Manchester ... ... June 7

Bristol.—Construction, delivery, erecting in place, fitting, testing, and maintenance for 12 months after completion, of four two-ton movable electric jib cranes, and one three-ton movable eleetric jib crane. Mr. W. W. Squire, engiueer, Cumberland Basin, Bristol ... ... June 7

Carshalton (Surrey).—Installation of engineering plant in boiler-house, engine, pump, and tank rooms, etc., at the Southern Convalescent Hospital, Carshalton-on-the-Hill, Surrey, for the Metropolitan Asylums Board, in accordance with drawings and specification prepared by Mr. W. T. Hatch, M.I.C.E., M.I.M.E., engineer-in-chief ... ... June 14

Hartlepool.—Construction of a self-propelling barge-loading dredger, capable of lifting 600 tons per hour and of dredging to a depth of 40 ft. below water level; also for the construction of a twin-screw steam hopper barge (hopper capacity 500 tons, speed nine knots loaded), for the Hartlepool Port and Harbour Commission Mr. J. D. Howkins, engineer, Hartlepool ... ... June 15

New South Wales.—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... Sep. 1

COMING CONTRACTS.

Brighton.—An inquiry has been held into the Council's application for sanction to borrow £11,617 for telephonic purposes.

Burslem.—An inquiry has been held into an application of the District Council for sanction to borrow £12,500 for purposes of sewage-disposal.

Derby.—An inquiry has been held into an application of the Corporation for sanction to borrow £30,000 in connection with a sewerage scheme.

Portsmouth.—The Corporation are seeking sanction to borrow £30,000 for electric supply purposes and the extension of the telephone system.

Ossett.—A proposal has been made to purchase, jointly with the Castleford District Council, the Deanhead reservoir, and constructing waterworks at an estimated cost of £127,000.

Dunfermline.—A water-supply scheme has been adopted. The cost of the undertaking is estimated at between £8,000 and £9,000.

Worthing.—Extensions of the electricity plant are proposed at a cost of £3,000.

CONTRACTS CLOSED.

Bournemouth.—The Town Council have accepted the following tenders in connection with the Christchurch tramway extension—British Electric Equipment Co., Ltd., steel poles, overhead equipment, section boxes, etc., £4,315; Johnson and Phillips, feeder cables, troughing, junction boxes, etc., £5,405 16s. 5d.—British Westinghouse Co., tramcars, £6,522.

Buenos Ayres.—J. G. White and Co., Ltd., have just secured a contract for the construction of the Rural Tramways. The amount of the contract is approximately £250,000.

Govan.—The tender of the Lancashire Dynamo and Motor Co., Ltd., has been accepted for the supply of motors for all sizes above 3 h.p.

Greenock.—The Corporation has accepted the tender of the British Westinghouse Co. for one 400 k.w. steam generator, at £2,900.

Horsham.—The District Council has accepted the tender of the British Westinghouse Co. for a steam balancer set for the E.L. station, at £1,018 10s.

Manchester.—The Corporation has placed an order with Messrs. Ferranti, Ltd., for continuous-current switchgear for the Dickinson Street generating station.

Marylebone.—The Electric Supply Committee has provisionally accepted the tender of Messrs. Chamberlain and Hookham for 5,525 two-wire meters, at £8,588 15s., and 110 three-wire meters, at £456 5s.

Admiralty.—Messrs. John H. Wilson and Co., Ltd., engineers, Liverpool, have been entrusted by the Admiralty with the orders for two powerful steam locomotive jib cranes to deal with 30 tons working loads and tested with 45 tons. These cranes are for use on the new graving docks at H.M. Dockyard, Portsmouth.

Newport (Mon.).—The tender of Messrs. Callender's Cable and Construction Company for electrical cables has been accepted at prices ranging from £49 to £625, for concentric cables per 1,000 yards; £67 to £673, concentric armoured; £137 to £692, triple concentric; and £166 to £750, triple concentric armoured.

Cardiff.—The Corporation Electric Lighting Committee has accepted the tender of the General Electric Company, Ltd., of London, for four motor-generator sets, at £4,956 18s.

Cumberland.—The tender of Messrs. Wylie and Lockhead, Ltd., of Glasgow, has been accepted for the installation of the electric light at Garlands Asylum, Cumberland.

Durham County.—The County Council has accepted the tenderof Messrs. C. A. Parsons and Co. Ltd., for electric plant to the County Asylum, at £5,143 13s. 9d.

The Admiralty have placed with Messrs. John I. Thornycroft and Co., Ltd., of Chiswick and Southampton, an order for five new torpedo-boat destroyers of a new type, intended for harbour and coast defence.

London.—The Brush Electrical Engineering Company, Ltd., have secured the following contracts: 300 k.w. steam dynamo switchboard extensions for Merthyr Electric Traction and Lighting Company; six double deck four-wheel cars with Raworth regenerative control equipments for Plymouth Corporation; twenty single-deck composite motor-cars mounted on radial trucks for North Metropolitan Electric Tramways Company; ten double-deck four-wheel carbodies for Stockport.

APPOINTMENTS VACANT.

Last Day.

Birmingham.—A professor of civil engineering at the university. Salary £600 per annum. Applications to Mr. Geo. H. Morley, Secretary, Birmingham University ... ... May 20

Johannesburg. — General manager to take charge of tramways lighting and power undertakings. Salary £2,000 per annum. A station engineer to take charge of generating station and tramways workshops. Salary £1,000 per annum. Applications to Messrs. Morley and Dawbarn, 82, Victoria Street, Westminster .. ... May 29

Manchester.—Electrical department. Shift engineer. Salary £150 per annum. Mr. W. H. Talbot, Town Clerk, Manchester ... ... May 22

Woolwich.—Engineer and surveyor to the borough council. Salary £500 per annum. Mr. Arthur B. Bryceson, Town Hall, Woolwich ... ... May 22

Coventry.—The Electric Lighting committee require a mains superintendent. Salary £150 per annum rising to £200. Mr. Geo. Sutton, 10, Hay Lane, Coventry. May 26th

APPOINTMENTS FILLED.

Perth.—The Town Council have appointed Mr. W. G. Snell (tramway inspector) as traffic superintendent of the tramway system.

Belfast.—Mr. A. N. Moore, assistant resident engineer at Stuart Street station, Manchester, has been appointed superintendent of both the old and new generating stations at Belfast.

Bahia Blanca.—Mr. Ernest Durham has been appointed second engineer at Bahia Blanca, under the South American Electric Light and Power Company.

District Railway Company.—The Right Hon. Lord George Hamilton M.P., and Mr. William H. Brown, have been elected directors of the Metropolitan District Railway Company.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—

Consols : June 1st. General Settlements : May 31st, June 15th, 29th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅜— 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4⅜— 5
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3¼—3⅜
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5¼— 5⅜
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	2/4½	Babcock and Wilcox, Ltd., Ord. ..	1	5⅜— 5⅝
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1 15/16 —1 1/16
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4⅜— 5¼
250,000	1	6¾d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 1/16 — 1 1/16
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	103 —105
150,000	4½	2/8½	Barrow Hæmatite Steel Co., Ld., O.	4½	1 15/16 — 1 15/16
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛— 4⅜
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104 —106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11⅞— 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	7/16— 9/16
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	25/32— 27/32
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	15/16— 1
1,860,900	1	3¾d.	Do. Nos. 1,639,101-3,500,000	12/-	½— 9/16
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅛ — 1⅛
590,000	1	6d.	Do. Ord., Nos. 1,160.001-1,750,000	1	1 9/16— 1 11/16
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11⅛— 11⅜
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord..	5	3⅜— 8⅞
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5 5/16— 5 5/16
450,000	1	1/2⅝	Clayton & Shuttleworth, Ltd., Ord.	1	15/16— 1
70,000	5	2/6	Do. 5% Cum. Pref.	5	5⅜— 5⅝
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	101 —103
100,000	10	7/6	Consett Iron Co., Ltd., Ord.. ..	7½	31¼— 32½
57 031	10	10/-	Crossley, Bros., Ld , Ord. 40340/97370	10	15⅞—16
40,339	10	5%	Do. 5% Cum. Pref.	10	11⅜—11⅝
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2¼— 2⅜
1,259,594	1	3¾d.	Dorman, Long & Co., Ltd.	1	31/32— 1
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Particip ating..	5	3⅜— 3⅝
250,000	1	9¾d.	Dunlop (James) & Co., Ltd., Ord...	1	1— 1
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	29/32 - 31/32
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½— 10⅜
69,754	13	12/-	Do. do. do.	10	7⅞— 7⅞
20,250	10	8/-	Elliott's Metal, Ltd.	8	4½— 5½
5,000	10	5%	Do. Cum. Pref. 5%	10	9½— 10
186,748	Stk	4%	Do. Deb. 4%	100	94½ — 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng.Co., Ltd., 6% Cum. Pref. ..	10	11 — 11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk .Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000..	10	12 —12¾
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½— 10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4⅜— 4⅞
21,000	8	1/6	Do. 7½% Cum. Pref.	3	5¾— 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red..	100	90¼—91½
16,800	10	—	Greenwood & Batley, Ltd., Ord..	10	4¼— 4½
9,600	10	7%	Do. 7% Cum. Pref.	10	10¼— 10⅞
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 5/16— 2 5/16
344,000	5	2/6	Do. 5% Cum. Pref.	5	6 — 6⅜
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 —107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3¼— 3⅜
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10¾— 11¼
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1 5/16—1 7/16
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	99 - 101
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	5 — 5½
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	11/16— 13/16
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾— 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5½— 5¾

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1⅛— 1¼
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	13 — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red after 1905	100	98 —101
37,500	10	20.	Kynoch, Ltd.	10	18½— 18⅞
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅜— 11
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	— —
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4¼
40,000	3	2/1½	Leeds Forge Co , 7% Cum. Pref. ..	3	3⅜— 4
200,000	1	7½d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16 — 1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt Deb. Stk., Red.	100	109 —111
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼—11¾
210,000	1	8½d.	Measures Bros., Ltd., Ord.	1	13/16— 15/16
75,000	1	6¾d.	Do. 5½% Cum. Pref.	1	15/16— 15/16
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21,943	5	2/6	Muntz Metal, Ltd.	5	4⅞— 5⅛
14,248	5	5%	Do. Pref. 5%	5	4⅞— 5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12 —12¼
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅞— 4⅛
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5⅝— 6¼
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	9¼— 10
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock .	100	97 —100
20,000	5	3/-	Peebles(Bruce) & Co.,Ld., 6% Cm.P.	5	5 5¼
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord ..	1	6/- —6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	4⅜— 4½
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	5/16— 7/16
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅜— 2
73,062	5	2/-	Do. New	5	1½— 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	101 —103
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000 ..	1	35/32— 37/32
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9½— 10
275.000	1	6d.	Scott (Walter) Ltd., Ord.	1	11/16— 13/16
300,000	1	7½d.	Do. 6% Cum. Pref. ..	1	15/16— 1 1/16
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	93 — 96
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250.000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	5/8— 11/16
300,000	1	1/2½	Do. 6%Cum. Pref...	1	13/16— 7/8
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	90 — 92
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5½— 5⅝
£125,240	Stk	5%	Do. 5% Trust Mort. Deb. ..	100	106½—107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2 — 2¼
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	4 — 4¼
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	77— 80
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17½— 18
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½— 15
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	3/8— 7/16
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅛ — 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 — 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	3/16— 11/16
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	76 — 80
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	¾— 1⅛
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ — 10
$508495200	$100	$3	United States Steel Corp. Com. Stk.	$100	32⅛— 32⅜
$360314100	$100	$1⅔	Do. 7% Cum. Pref. Stock	$100	101¼ 101⅜*
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	96— 98
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord..	1	2⅝—2⅞
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1 5/16— 1 5/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	118 —121
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	105 —107*
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	107 —109
225,000	1	1/2⅝	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16— 15/16
500,000	1	7½d.	Do. 6% Cum. Pref. Ord. ..	1	⅝— 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	81 — 85
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4⅜— 4¾
300	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	1½ — 2½
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	75 — 80
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	76—78

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	5/8 — 7/8
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16 — 9/16
120,000	1	1/2½	Bell's Asbestos Co., Ltd.	1	15/16 — 1 1/16
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½ — 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½ — 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	102 —105
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red..	100	100—102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 5% Pref..	5	2 13/16 — 3 1/16
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	89 — 91
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	1/2 — 3/4
150,000	2	2/4⅔	Do. 6% Pref.	2	1 3/8 — 1 7/8*
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 — 11½
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5 3/4 — 5 7/8
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	107 —109
85,000	3	1/6	Crompton & Co., Ltd...	3	2 — 2¼
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95—100%
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7½ — 8
61,000	5	8/-	Do. 6% Cum. Pref.	5	5 3/4 — 6
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	107 —110
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅛ — 1⅜
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2¼
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	82 — 87
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	87 — 92
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	7/8 — 1⅛
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	2¼ — 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	96 — 99
10,248	10	7/6	Evered and Co., Ltd...	10	11 — 13
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½—12½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5½ — 5 3/4
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 — 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/8—16/9
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	34 — 36
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 —105

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¼ — 8½
260,007	5	2/6	Do. 5% Cum Pf.	5	5 7/8 — 6 1/8
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	141 —144
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	11¼—11¾
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9¾-- 10¼
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	3/4 — 7/8
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	15/16 — 1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	3/4 — 1¼
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾ — 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	103 —106
		%	Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9 — 9½
156,437	10	6/-	Do. 6% Cum. Pref.	10	10¾ — 11¼
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	121 --123
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	96 --98
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3⅜ — 3⅝
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5 5/16 — 5 7/16
27,000	5	3/-	Do. "B" do.	5	5¼ — 5½

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	97 — 99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101 —105
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	8¼ — 8½
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107 —109
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅛ — 1⅛
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4 7/8 — 5 1/8
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —103
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13¾ — 14¼
59,987	10	6/-	Do. 6% Pref...	10	15½ — 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2⅞ — 3¼
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	85 — 90
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9⅜ —10½
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	99 —102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	101 —103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	9/32 — 11/32
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 — 1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105 —107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1¼
110,923	8	3/2⅖	North Metropolitan Tramways Co..	8	4¼ — 4⅜
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	105 —108
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	9 — 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¼ — 9⅜
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101 —104*

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11⅜ — 12½
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10— 10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106 —108
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5⅛ — 5⅜
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 —105
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9½ — 10½
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9½ — 10½
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	8½ — 8⅝*
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	7½ — 8⅛
80,000	5	2/3	Do. do. 4% Cum. Pref...	5	5⅜ — 5⅝
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	105 —107
41,436	5	9/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6½ — 7
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109 —111
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11½ — 12
40,000	10	6/-	Do. 6% Cum. Pref.	10	13¾ — 14¼
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	124 —128
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	104 —106
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	8⅜ — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12¾
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	112 —115
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¾ — 6¼
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	107 —109
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 — 104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½ — 10⅜
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ — 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	¾ — 7/8
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12 — 13

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount bscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 —103
111,000	3	1/9⅔	London Elec. Supply Corp., Ld., Ord.	3	2¼ — 2¾
60,000	5	8/-	Do. 6% Pref.	5	5¼ — 5¾
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 —101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18 — 19
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5¼ — 5⅝
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —114
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99 —101%
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½—15¼
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼— 6⅝
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	14 —15
20,000	5	3/6	Do. 7% Pref.	5	8¼— 8¾
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 3⅛
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3¾ — 4¼
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16 - 15/16
50,000	1	8¾d.	Do. 7% Cum. Pref.	1	1 5/16—1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅞ — 5⅛
30,000	5	2/6	Do. 5% Cum Pref.	5*	5 — 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12 —13
28,151	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	15/-	Anglo-American Tel. Co.. Ltd., Ord.	100	59 — 61
£3,118,210	Stk	30/-	Do. 6% Preferred Ordinary	100	105½—106½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	15¼—15⅝
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅝— 6¾
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	———
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97 — 99
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¼— 8⅜
6,000	10	10/-	Do. 10% Preference .. .	10	15 — 16
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Prefereuce	5	8½— 9
£30,000	50	4½%	Do. 4½% Debs...	50	101-103%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11¼—11½
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Db.	100	100—102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	99-101%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd. .	10	14 — 14½
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£1,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	139 —142
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	91 — 93
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	107 —109
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	34 — 35
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	50 — 52
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	⅜— ⅞
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	108⅝—109⅝
£1,966 667	Stk	5%	Do. Deferred	100	101 —103
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5¼ — 5⅜
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100—102
£689, 93	Stk	4%	Do. 4% do. do. ..	100	103¼—105½
179,313	1	8⅜d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ — 1⅜*
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ — 1¼
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	99 —102
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7⅞ - 8¼
59,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6⅜ - 7¼
40,000	5	2/6	Do. 5% Cum. Pref. . ..	5	5 — 5½
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107—109
15,609	10	4/-	W. African Telegraph Co., Ltd. .	10	8 — 8½
£30,0	2½	—	West Coast of America, Ltd. ..	2½	⅜ — ½
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 —102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅝ -- ¾
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8¼— 8½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	7¼ — 7½
£80,000	100	5%	Do. 5% Deb.	100	104 —106
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½ — 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½— 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99—101
£672,900	Stk	4½%	British & African Stm. Nav. (1900), Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	97 — 99
10,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	101 —103
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11¾ -- 12¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	99—101
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 3/16—1 5/16
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5¼
36,758	8	4/9⅔	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3 — 3½
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	88 — 90
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	4¼— 4¾
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	132 —135
£1,160,000	Stk	19%	Do. do. Deferred ..	100	228 —231
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	29 — 30
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4¼
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8½— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref...	10	10½— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	101 —103

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60 000	1	9¾d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 1/16—1 3/16
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	127 —132
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	5/16— 7/16
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	7/16— 9/16
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16— 1 3/16
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

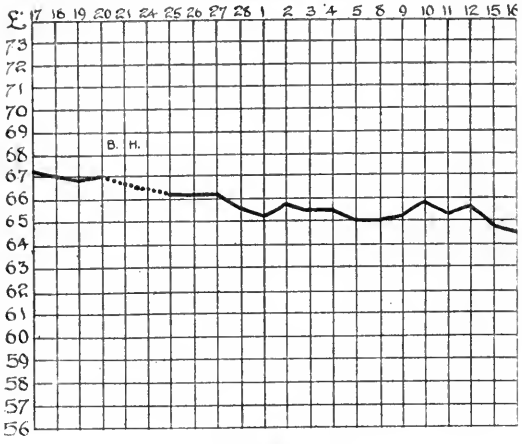
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car, & Wagon, L., 1-10,000	10	22½—23
8,739	10	3/-	Do. Second Issue 1-8,739	4	8⅜— -
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50 000	7	9 — 9¼
44,889	7	3/6	Do. B, 29.862-49,750, 50,001-75,000	7	4 — 4¼
14,567	10	1/3	Lancashire Wagon, Ord. .. .	2	2⅞—2⅝
4,150	10	5%	Do. do.	10	10½ — 10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/—44/-
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/— 25/-
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	24/— 25/-
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

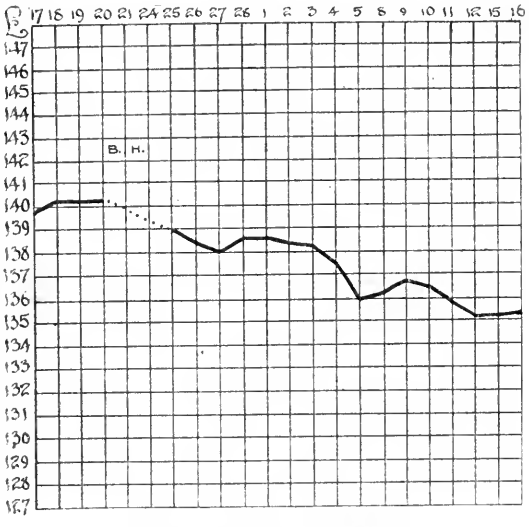
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM APRIL 17TH TO MAY 16TH, 1905.

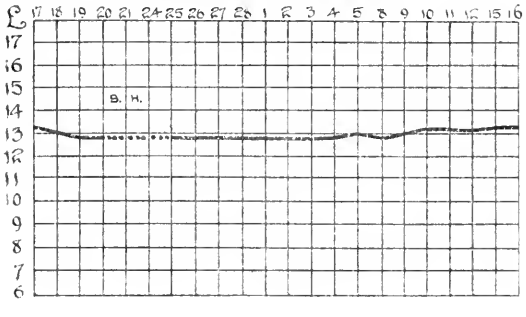
COPPER.



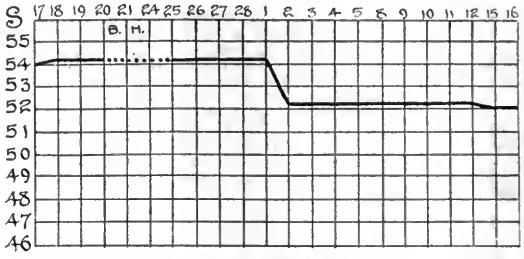
TIN.



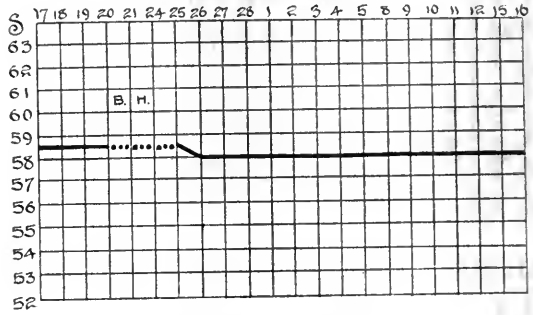
ENGLISH LEAD.



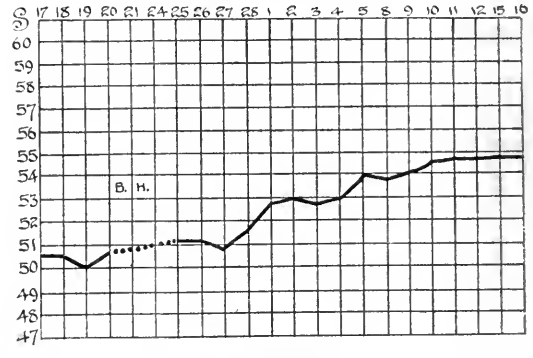
PIG IRON: SCOTCH,



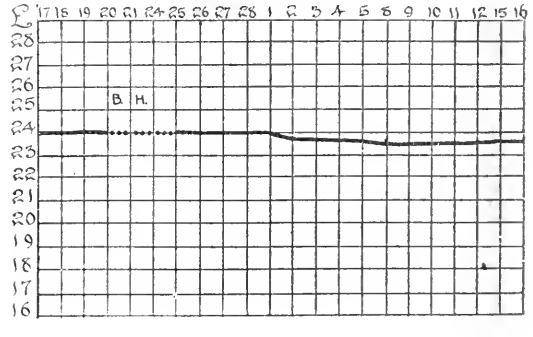
HEMATITE,



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, May 17th, 1905.

THE situation of Copper is not altogether encouraging, but after frequent fluctuations in prices, the market closes at £64 10s. Support is forthcoming whenever the quotation falls below £65, so that although it is clear there is a large bull account open, it is in fairly strong hands, and attempts to bear the market have been on the whole unsuccessful. Messrs. Merton and Co.'s circular gives the visible supply at May 15th as 16,883 tons against 18,055 tons at the end of April. Some doubts are being cast on the strength of the American position, which is said to have been over-rated, and the market is rather waiting on events.

Tin has exhibited an irregular tendency, American buying having been followed by realisations, but the latest appearance of the market is rather firmer, with buying orders for forward delivery. The official returns show a slight decrease in the Straits production for the last fiscal year, but it may be noted that the shipments for the twelve months ending April 30th last, are in excess of those for the previous twelve months. In view of the scarcity of labour, however, there is not likely to be any particular increase in production in the immediate future. London stocks are still below the average and pending the Banca sale, some tightness in the market is to be expected. The closing prices are £135 10s. cash, and £134 5. three months.

Lead is somewhat stronger, consumers having had to pay higher prices for near delivery, and although speculative dealings have been on a small scale, there is a strong undertone to the market, and quotations look like going better. The final prices are soft foreign £12 17s. 6d., and English £13 2s. 6d.

Spelter is weaker on bear sales by Continental operators, while inquiries from consumers are falling off. The closing prices are £23 15s. for ordinaries and £24 specials.

The squeeze in Middlesbrough iron continues and the clique have put the price up to 55s. for immediate delivery. Business with consumers and shippers has been practically at a standstill, owing to the market being so much in the hands of speculative dealers, and the price, one month's iron, has reacted to 46s. 6d. Standard iron is quoted at 44s. 9d. one month. Scotch closes rather lower.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:	£	s.	d.
DALZELL STEEL Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
,, ,, ,, Land ,, ,, ...	6	17	6
,, Steel Bars, Boiler Quality	6	17	6
DALZELL STEEL Siemens' Steel Plates, Ship Quality Plates.....	5	17	6
,, ,, Bars ,, ,, ...	6	7	6
,, ,, Angles.....	5	7	6

Manufactured Iron:			
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle.....	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.	
Steel Angles (Glasgow Steel).....	5	7	6	per ton.
Steel Ship Plates (Glasgow Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quote:—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best.....	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
Best Scrap Rivet	7	5	0

	£ s. d.
Angles—Phœnix	6 5 0
,, Best	6 15 0
,, Extra Best	7 5 0
Gas Tube Hoops—Phœnix Best	6 15 0
Plates—Phœnix	—
,, Best Boiler	7 10 0
,, Best Best Boiler	8 0 0
,, Extra Best Boiler	9 0 0
Boiler Tube Strips—Phœnix Best Best	8 0 0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £ s. d.	No. 3. £ s. d.
Coltness, f.a.s. Glasgow	3 4 6	2 14 0
Gartsherrie ,,	2 19 0	2 14 0
Summerlee ,,	2 19 0	2 14 0
Carnbroe ,,	2 16 6	2 12 6
Langloan ,,	3 4 0	2 15 0
Calder ,,	2 19 0	—
Clyde ,,	2 18 6	2 13 6
Glengarnock, f.o.b. Ardrossan	2 18 0	2 12 6
Eglinton ,, ,,	2 14 6	2 12 6
Dalmellington, ,, Ayr	2 14 6	2 12 6
Shotts ,, Leith	2 19 0	2 14 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£ s. d.
W.W. Crown Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby Crown	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W. Crown Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron. £ s. d.	Steel. £ s. d.
Crown (BNF)	Bars	6 10 0	6 15 0
	Angles	7 0 0	7 5 0
	Tees	7 10 0	7 15 0
Crown W.I.W	Hoops	7 0 0	7 10 0
	Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 90in. by 36in. per ton. £ s. d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £ s. d.
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in
Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£ s. d.	£ s. d.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £ s. d.	Doubles 21 to 24 G to 96 by 36in. per ton. £ s. d.
Best Coke (Finish)	29 0 0	30 10 0
,, Charcoal (Finish)	31 0 0	32 10 0
Extra ,, ,,	33 0 0	34 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.
At works.

Galvanized Corrugated Sheets:

	£ s. d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11 12 6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14 5 0	,,

Galvanized Working Up-Sheets:

	£ s. d.	
24 G., f.o.b. London, in Bundles	13 2 6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.	
Crown Bars	6 10 0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7 0 0	,,
Angles	6 15 0	,,
,, Best	7 5 0	,,
T's	7 0 0	,,
,, Best	7 10 0	,,
Best Shoe Iron	8 0 0	,,
,, Rivet Iron	8 0 0	,,
,, Best Rivet (Special)	9 5 0	,,
,, Cable	9 5 0	,,
,, Screwing	8 5 0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

Coke Tin-plates.	Per Box. f.o.b. Wales. £	s.	d.
C 18¾ by 14 124s. 110 lb. "BV"	0	12	3
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	10½
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	0

Charcoal Tinplates:

C 20 by 14 112s. 108 lb. "Allaway"	0	12	7½

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	16	0	per ton.
Billets	at 3	18	0	,,
Sheet Bars	at 4	0	0	,,

Finished Steel:

Bars	at 5	2	0	per ton.
Angles	at 5	3	0	,,
Tees	at 5	6	0	,,
Joists	at 4	10	0	,,
Fencing Standards	at 5	3	6	,,
Shoeing Bars	at 5	5	0	,,
Tyre Bars	at 5	5	0	,,
Half-Round Bars	at 5	10	0	,,
Heavy Rails	at 5	5	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	135	0	0	to	135	10	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	136	0	0	to	136	10	0	,,
Straits G.M.B., cash Warehouse, Net	135	2	6	to	135	5	0	,,
Straits G.M.B., 3 months, Warehouse, Net	134	0	0	to	134	2	6	,,
Australian, Mt. Bischoff, Warehouse, Net	137	0	0	to	137	10	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	64	10	0	to	64	12	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	64	10	0	to	64	12	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	69	0	0	to	69	10	0	,,
English, Best Select, Warehouse Net	70	0	0	to	70	10	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	78	0	0	to	79	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	74	0	0	to	74	10	0	,,
Electro, Warehouse, Net	69	15	0	to	70	0	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit.
Regulus, Matte and Precipitate, ex ship,	0	13	3	to	0	13	9	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6½	per lb.
Sheathing ,, ,,	0	0	6⅝	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	10	0	to	23	15	0	per ton.
Blende of 50 % Net	6	11	6	to	6	12	6	,,
Calamine, Net	6	14	0	to	6	15	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	13	2	6	to	13	5	0	per ton.
Spanish, ex ship, Dis. 2½%	12	17	6	to	12	18	9	,,
Lead Ore of 70 %, Net	6	8	0		—			

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	37	0	0	to	37	10	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	9	10	0	to	10	10	0	,,
Crude, ex ship, Dis. 2½ %	15	10	0	to	17	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	—			per flask.
Italian ,, ,, ,,	7	5	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	7	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

Steam.

	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

High Hazel.

London Brights, 4 to 8 in. cube	10	6
Large Nuts, 2 to 4 in. cube	8	6
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

Steam.—Top Hard.

Best Hard	8	6
Hard Steam	7	6
Cobbles	6	6

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	11	,,
	Tartaric at Manchester	0	0	10⅞	,,
Acetate of Lime:	Brown at Manchester net	9	15	0	per ton.
	Grey ,,	12	0	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, deld. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	12	6	,,
Arsenic:	Best White Powdered net	12	5	0	,,
Bleaching Powder,	35% ,,	4	10	0	,,
Borax:	British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:

Benzole, 50/90%	,,	0	0	6	per gal.
,, 90%	,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C.	,,	0	0	6	per lb.
,, ,, ,, 39/40° C.	,,	0	0	6¼	,,
,, ,, Liquid, 97/99%	,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b.	,,	0	1	10	,,
Creosote, ordinary good liquid	,,	0	0	1 7/16	,,
Naphtha, Crude, 20% at 120° C.	,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b	,,	0	0	8	,,
,, ,, 95% at 160° C. ,,	,,	0	0	9	,,
,, ,, 90% at 190° C. ,,	,,	0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b.	,,	0	1	0	,,
Naphthalene, all qualities.					
Pitch f.a.s. Manchester.	,,	1	9	0	per ton.
Copperas: Green, in bulk	,,	0	12	6	,,
,, barrels f.o.b. L'pool	,,	1	19	0	,,
Cake	,,	1	2	6	,,
Copper: Sulphate		21	0	0	,,
Cyanides: 98% minimum f.o.b.	net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English		27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K		23	5	0	,,
,, ,, Grey		21	15	0	,,
,, ,, Brown at Manchester		16	15	0	,,
Nitrate		24	0	0	,,
Litharge, Flake		15	10	0	,,
,, Powder		16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%		15	10	0	,,
White ,, ,, Dry ,, ,, ,,		16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.		0	2	10	per gal.
Solvent		0	2	7	,,
Potash: Bichromate... delivered England		0	0	3	per lb.
Carbonate, 90/92% ... c.i.f Hull		18	5	0	per ton.
Caustic, 75/80% ,, ,,		20	10	0	,,
Chlorate net		0	0	3 1/16	per lb.
Montreal in Store, Liverpool		34	0	0	per ton.
Prussiate, Yellow net		0	0	5	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... net	5	5	0	per ton.
	,, ,, ,, Refined..... ,,	6	5	0	,,
	,, Carbonated, 48 %..... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) .....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % ..... net	6	10	0	,,
	Caustic, White, 77 %..... ,,	10	10	0	,,
	,, ,, 70 %..... ,,	9	12	6	,,
	,, ,, 60 %.. ..... ,,	8	12	6	,,
	,, Cream, 60 %..... ..... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate ..... c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs.....	6	15	0	,,
	Bichromate.....delivered England...	0	0	2¼	per lb.
	Chlorate ..... net	0	0	3 1/16	per lb.
	Nitrate.. ex quay Liverpool, ... ,,	11	5	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate .....net	0	0	3⅜	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts).....	1	12	6	,,
	,, (Saltcake, 95%).....	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers.....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	7	5	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote:—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports.....	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre:	French JC ..... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk)..... c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote:—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	0	to	0	13	0	per unit.
Regulus, 45 to 55%	0	13	3	to	0	13	9	,,
Precipitate, 65 to 80% ...	0	13	4½	to	0	13	10½	,,
Tin Ores, 70 %.....	86	0	0	to	88	0	0	per ton.
Lead Ore, 70%					6	8	0	,,
Blende, 50%					6	11	6	,,
Calamine.....					6	14	0	,,
Antimony Ore, 50%.....	9	0	0	to	10	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote:—

Iron Ore.

			s.	d.	
Ord. 50%, ...f.o.b.	Porman		6	4	per ton.
Do. ..... ,,	Cartagena		6	7	,,
Special low phos. ,,	Porman		7	0	,,
Do. do. ,,	Cartagena.....		7	3	,,
Extra quality do. ,,	,, ...		7	8	,,
Special Iron Ore ,,	,, ...		8	4	,,
Specular 58% do. ,,	,, ...		9	4	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine.....	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks.....	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	7	10	0		7	15	0
Nova Scotia Spruce...	,,	7	0	0		7	10	0
Spruce Boards.....	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak.....	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.....	,,	0	1	2		0	1	9

Deals.

Red Archangel and Onega, 1st quality	per std	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics*.

9080. L. S. Hinks, Sanderstead. May 1st.—Improvements in tabs and swivel joints.

9085. W. Slingsby, Bolton. May 1st.—Improvements in apparatus for charging retorts used in the manufacture of gas.

9089. W. J. Pickering, Birmingham. May 1st.—Apparatus for regulating and measuring the amount of neutraliser required to be added for softening the feed water for steam boilers.

9098. H. Soehnlein, Germany. May 1st.—Gas engine.

9105. A. L. Forster, London. May 1st.—Improvements relating to conveying machinery.

9123. J. Robertshaw, Halifax. May 1st.—Improvements in or connected with steam boilers.

9126. M. Gehre, London. May 1st.—Improvements in apparatus for measuring the supply of steam from steam generators.

9127. J. E. Howard, London. May 1st.—Improvements in pneumatic revolving drills and similar revolving tools.

9130. T. Fryer, London. May 1st.—Improved construction of bolt and nut.

9142. E. T. Freeman, J. L. Capeland, and H. D. W. Boyd, junr., London. May 1st.—Improvements in and relating to self-draining faucet or bib cock.

9153. A. Schmidhauser, E. Jeanrenaud, and A. Crausaz, London. May 1st.—An improved universal wrench.

9157. J. W. Bowley, Birmingham. May 2nd.—Improvements in steam and other turbines.

9159. H. T. Logan, Erith. May 2nd.—Improvements in or relating to reciprocating engines.

9163. R. Motion, Glasgow. May 2nd.—Improvements in water heating and steam generating apparatus.

9168. W. Mills, Manchester. May 2nd.—Improvements in spikes for racing pumps.

9180. W. S. Thompson, Dundee. May 2nd.—Improvements in and relating to cranes.

9182. F. Niblock, Wallasey. May 2nd.—An improved form of equilibrium valve for high-pressure steam.

9184. F. Niblock, Wallasey. May 2nd.—An improved form of piston ring for steam pistons.

9193. R. H. Peck, London. May 2nd.—Improvements relating to steam traps and air valves.

9196. T. Suzuki, London. May 2nd.—Improvements in vertical boilers.

9218. W. J. Fraser, London. May 2nd.—Improvements in connection with turbine and like motors.

9223. W. Blanc and L. Paiche, London. May 2nd.—Improvements in and relating to bearings for shafting and other purposes.

9227. A. Peck, London. May 2nd.—An improvement in submarine vessels. (*W. Peck, Australia.*)

9240. W. S. Worthington and H. S. Southworth, Liverpool. May 2nd.—Improvements in or in connection with water gauges.

9259. O. Kolb, London. May 2nd.—Improvements in turbines.

9272. J. Muhlrad, London. May 2nd.—An improved lubricator for bearings or the like.

9308. W. J. B. Loake and F. Green, Watford. May 2nd.—A reversing valve for steam and other cylinders.

9322. D. Honeywood and F. A. Ellis, London. May 2nd.—Improvements in rotary engines.

9326. J. Aitken, London. May 2nd.—Method and means for obtaining double expansion in a single cylinder of elastic fluid engines.

9327. J H. Corthésy, London. May 2nd.—Improvements in steam and other rotary gas engines or turbines.

9334. F. C. Buck, London. May 2nd.—Improvements in valves and cocks.

9341. W. Schmidt, London. May 2nd.—Improvements in steam superheaters.

9342. W. Schmidt, London. May 2nd.—Improvements in superheaters for flue tube boilers.

9343. W. Schmidt, London. May 2nd.—Improvements in superheaters for locomotive, marine, and other boilers with flue tubes.

9364. J. M. Birt and H. W. M. Birt, London. May 4th.—Improvements in apparatus for ironing or calendering machines.

9377. G. Miettinen, London. May 4th.—Improvements in rotary engines or turbines.

9413. A. B. Wilson, Belfast. May 4th.—Improvements in belt or rope pulleys driven by De Lavel steam turbines.

9416. J. S. Fairfax, London. May 4th.—Improvements in or relating to speed reduction and reversing gear for screw propeller shafts.

9421. E. Ruud, London. May 4th.—Improvements in jackets or casings for water heaters.

9428. E. Pulsford, London. May 4th.—Improved marine propeller applicable also to torpedoes.

9442. F. Grunewald, London. May 4th.—Apparatus for facilitating the starting and stopping of reversible compound machines. (Date applied for, May 5th, 1904.)

9451. H. Lentz, London. May 4th.—Improvements in and relating to locomotives.

9460. G. M. Sutter and R. Simpson, Liscard. May 5th.—Perpetual motion engine.

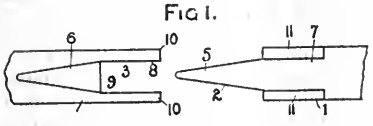
9461. R. Brown, London. May 5th.—Improvements in automatic exhaust valves.

RECENT SPECIFICATIONS.

"AN IMPROVED RAILWAY JOINT."

Hardin Hines, Alamosa, Colorada, U.S.A. February 23rd, 1905.—The invention relates to improvements in rail joints, and consists in a joint comprising a

FIG 1.



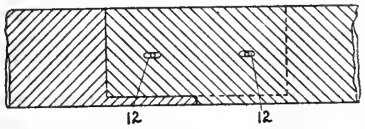


FIG 2.

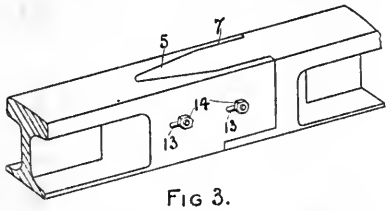


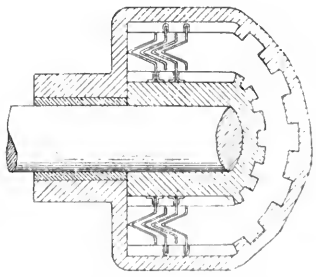
FIG 3.

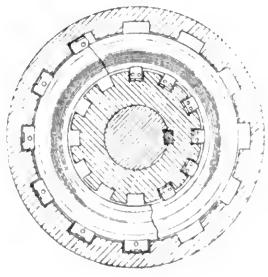
tongue formed upon one member having a tapering end portion and a portion of uniform thickness, together with means at the base of the rail forming lateral supports, the other member of the joint being provided with a complementary socket having a tapering portion and a portion of uniform width, the second member being also provided with a base seat or support. In the drawings fig. 1 is a top plan of the members constituting a rail joint constructed in accordance with the present invention, the members being somewhat separated. Fig. 2 is a longitudinal central section through the rail joint, the parts being in their assembled position; and fig. 3 is a perspective view of the rail joint. The illustration shows the preferred form of the members of the joint, one member being formed with a tongue which is adapted to fit into a socket formed in the other member of the joint. The tongue is preferably made of a depth almost equal to the entire depth of the rail, as shown in fig. 2. The outer end of the tongue is tapered to fit a correspondingly tapered portion of the socket. The inner end of the socket is closed at the bottom, the closed portion forming a shelf or tongue support upon which the tapered end of the tongue rests when the parts are assembled. Both the tongue and the jaws forming the socket are provided with elongated apertures, which coincide with each other when the tongue is in place in the said socket, as shown in figs. 2 and 3. Securing bolts are preferably passed through the said apertures for securing the parts together. It is of importance that the tongue have a straight portion for a part of its length, since the movement of the parts with respect to each other under the action of expansion and contraction will not operate to permit any lateral play between the tongue and the walls of its socket. The ends of the tongue is always supported by the floor of the socket, even though the tongue be withdrawn to some extent. It will also be observed that the ends of the socket member are also supported by the lateral flanges or shelves. By thus supporting the opposite ends of the joint members, the depression of the joint under the weight of passing trains is prevented even though the joint is not supported by sleepers or other means beneath. In laying rails thus connected it is not needful that care be taken to place the joints upon sleepers, as is usually the case in laying ordinary rails. The construction of the ends of the rails forming the joint is simple and very strong and capable of withstanding vertical and lateral strains.

IMPROVEMENTS IN FRICTION CLUTCHES, BRAKES, DYNAMOMETERS, AND THE LIKE.

H. S. Hele-Shaw, F.R.S., of Liverpool. March 13th, 1905.—This invention relates to friction clutches, brakes, dynamometers, and the like, and has reference more particularly to the friction plates in such clutches. In clutches of the class to which the invention relates there are two sets of plates, one set connected to the driving sleeve, and the other set connected to the driven casing, the connection being made by providing each set of plates with teeth adapted to engage in a series of grooves formed in the driving and driven parts respectively; when the plates are subjected to axial pressure causing frictional engagement, the power is transmitted from the driving to the driven part through the teeth of the respective plates; when the axial pressure is withdrawn the plates should separate slightly to free each other so that the clutch may run free, and this separation is generally assisted by small springs placed between adjacent plates of a set. It is essential in clutches in which the engaging surfaces consists of two sets of plates that these plates shall be comparatively thin in order to ensure an even and reliable action free from the possibility of sudden seizure and heating. When the power to be transmitted is considerable, there is a tendency for the edges of the teeth of the plates, when the plates are in their engaged positions and transmitting power, to indent the sides of the grooves of

Fig 1. *Fig 2*





the clutch members; even a slight series of indentations thus formed will, when the engaging pressure is released, tend to retard the prompt separation of the plates which would otherwise take place, and a more severe indentation may in some cases prevent separation when the engaging pressure is removed.

NEW PUBLICATIONS.

"VALVES AND VALVE-GEARING."

A practical text-book for the use of engineers, draughtsmen, and students. By Charles Hurst. Fourth edition, with frontispiece, numerous illustrations and seven folding-plates. Charles Griffin and Company, Ltd. 10s. 6d.

Mr. Hurst's lucid treatise has already received attention in this column, the new edition has been considerably enlarged and fresh matter has been added dealing with gas engine valves, air compressor valves and pump valves. Particulars of Corliss dashpot springs, a table of sizes of catches, and the proportions and designs of various details have been included in the section devoted to the steam engine, and a number of illustrations which in previous editions were merely diagrammatic have been superseded by practical designs which serve the double purpose of defining the proportions and illustrating actual practice.

"AMERICAN TOOL MAKING,"

And Interchangeable Manufacturing. By Joseph V. Woodworth. E. and F. N. Spon. 17s. net.

From its introduction, where it is claimed that the American tool maker is the most skilled mechanic in the world, to the conclusion, where it is maintained that he and his kind are capable of designing and making special machinery, tools, and devices for economical manufacturing in a manner "truly marvellous," this book is essentially American. Yet despite the sound of the trumpet, the volume, which is the outcome of the accumulated knowledge gained by the author during many years' practical experience, is one of exceptional usefulness. In arranging the text and illustrations the author has aimed at giving accurate and concise descriptions of the fundamental principles, methods, and processes by which the greatest accuracy and highest efficiency may be attained in the production of repetition parts of metal at the minimum of cost. There are 600 illustrations from original drawings by the writer; many of these depict special tools, while their construction and use are fully discussed in the letter-press. The scope of the volume is widely comprehensive, and it is equally suitable for the student's perusal or as a work of reference.

BOOKS RECEIVED.

"The Telegraphists Guide" to the Departmental and City and Guilds Examinations in Telegraphy. By James Bell and S. Wilson. (S. Rentell and Co., 2s. net.) A considerable number of improvements have been made in this new edition which should be in the possession of all who purpose sitting for the various examinations in telegraphy.—"The Home Mechanic," or how to put things right oneself. By John Wright. (John Murray, 6s, net.) A non-technical work, the aim of which is to initiate the young amateur into the use of tools, etc.; an amount of extraneous matter appears to have crept in, and we would suggest that subsequent issues would benefit by a discreet use of the pruning knife.—"A Lecture on Organ-Blowing." By Hugh Swanton, (The Kinetic-Swanton Company, Ltd.), contains some informing notes on the Kinetic Blower, which should be read by all interested in the mechanical blowing of organs.—"Painters' Oils, Colours and Varnishes," edited by Paul N. Hasluck. (Cassell and Co. 2s.) This excellent little handbook, which is illustrated with numerous diagrams, will be found very serviceable to the practical man.

NEW CATALOGUES.

Gent and Co., Ltd., Faraday Works, Leicester. A catalogue concerned with the all important question of time in workshops and other buildings, public and private, describes and illustrates the patent-silent electric impulse clocks, and impulse transmitters manufactured by this firm. Attention is particularly drawn to the weak battery warnings which are here described. The warning is given by a bell when the battery requires recharging—an arrangement which frees the system from the only charge that can be brought against battery-driven clocks, viz., that the battery might fail, and the dials stop without warning. A new development is dealt with at page 21 in connection with "Greenwich time" control. In some instances where it is necessary that any regulation shall be accomplished by the Greenwich time signal, a chronographic attachment can be fitted to the impulse transmitters, so that every morning at 10 a.m., by the signal sent daily to all telegraph offices, the transmitter is corrected instantly of the error that it may have acquired, if any, during the past 24 hours. A connection to the nearest telegraph office is, of course, necessary, for which a small annual charge is made by the authorities, such charge generally including the necessary wiring from the telegraph office to the subscriber. In the best previous practice of automatic regulation from Greenwich it has been customary to set the system to lose or gain up its error during the day, or, in accordance with another method, to stop a gaining system at 10 a.m., leaving it entirely dependent on the arrival of the Greenwich signal to restart it. By the firm's improved method of automatic regulation from Greenwich, the "impulse" is set forward if slow, and backward if fast. This method of course is far in advance of previous practice, being one of immediate correction.

Binney and Son, London, E.C. Asblubric lubricants are described in a price list just to hand, the following advantages being claimed for them. Extreme viscosity under heat ensuring exceptional wearing power and great economy; high flashing point and freedom from acid. No tendency to gum and no charring in cylinders; freedom from grit by double filtration, and absolutely uniform qualities. No. 16 asblubric is a grease lubricant specially compounded with graphite and other ingredients, and is specially recommended for use in Stauffer and other patent screw or spring lubricators.

Mather and Platt, Ltd., of Manchester, have just published a second edition of their valuable illustrated pamphlet on "Artesian Wells and Bore Hole Pumps." Readers abroad who are inquiring about this machinery are advised to mention the diameter and intended depth of the borehole, the natural water level of the district, particulars of the strata, if known, and the headroom and ground space available for the boring plant. If steam is available for the boring plant, pressure should be stated; also the quantity of water to be lifted per hour by the permanent pumping plant, and the height above the ground level to which the water has to be forced, or the total head. The method proposed for driving the pump, whether by steam engine, electric motor, gearing, or otherwise, should be given, with full details of steam pressure available or details of current used.

PAGE'S WEEKLY

Miscellaneous

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EFFICIENCY, SIMPLICITY & ECONOMY

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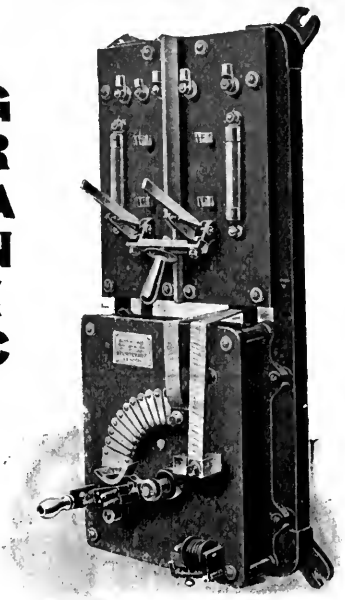

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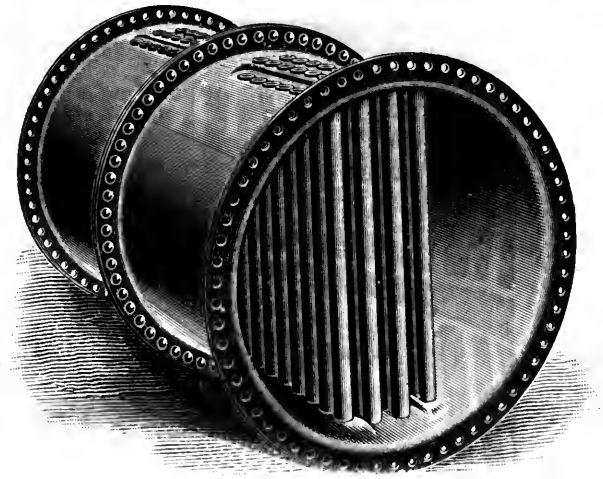
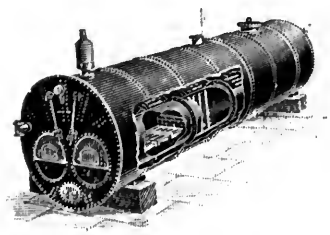


Part view of Flue fitted with PREMIER TUBES.



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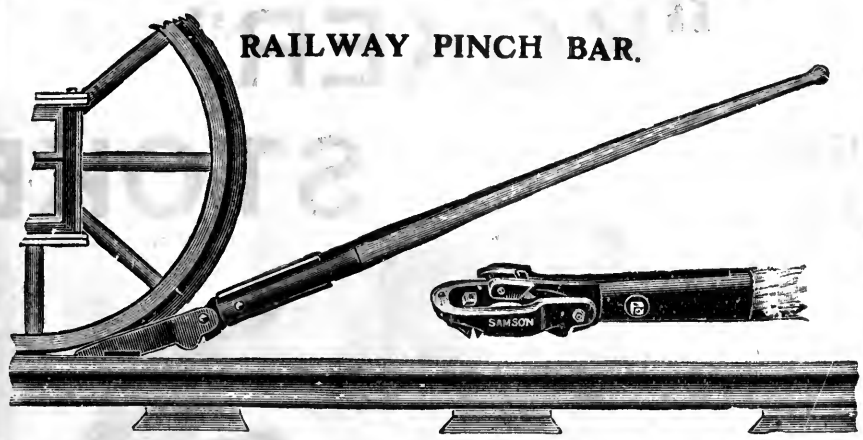

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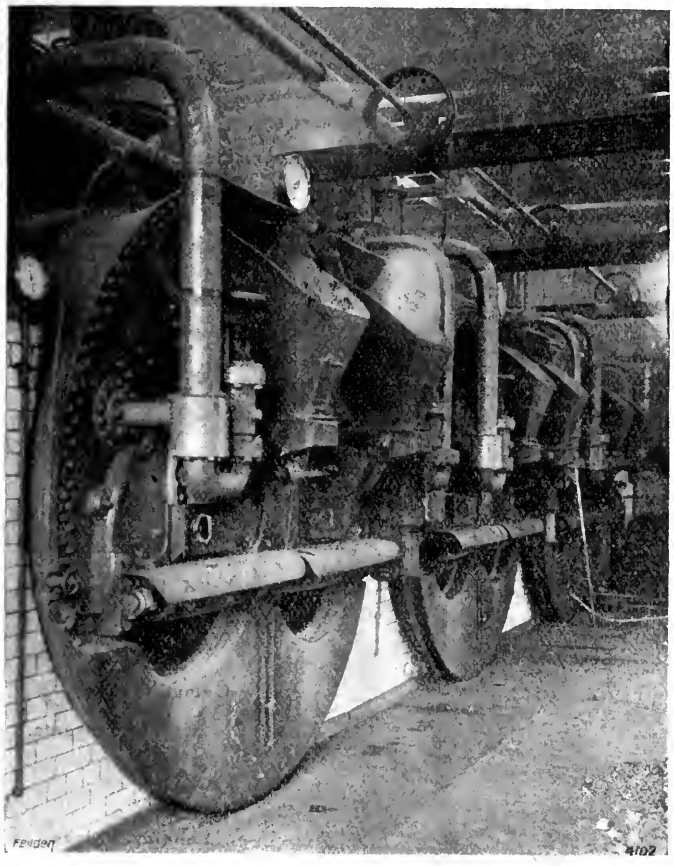
PAGE'S WEEKLY — Stokers

BENNIS STOKERS

AND

Compressed Air Furnaces.



Photograph of Boiler House in a Cotton Mill, showing Bennis Stokers and Compressed Air Furnaces.

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Economical.

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PAGE'S WEEKLY — Boilers

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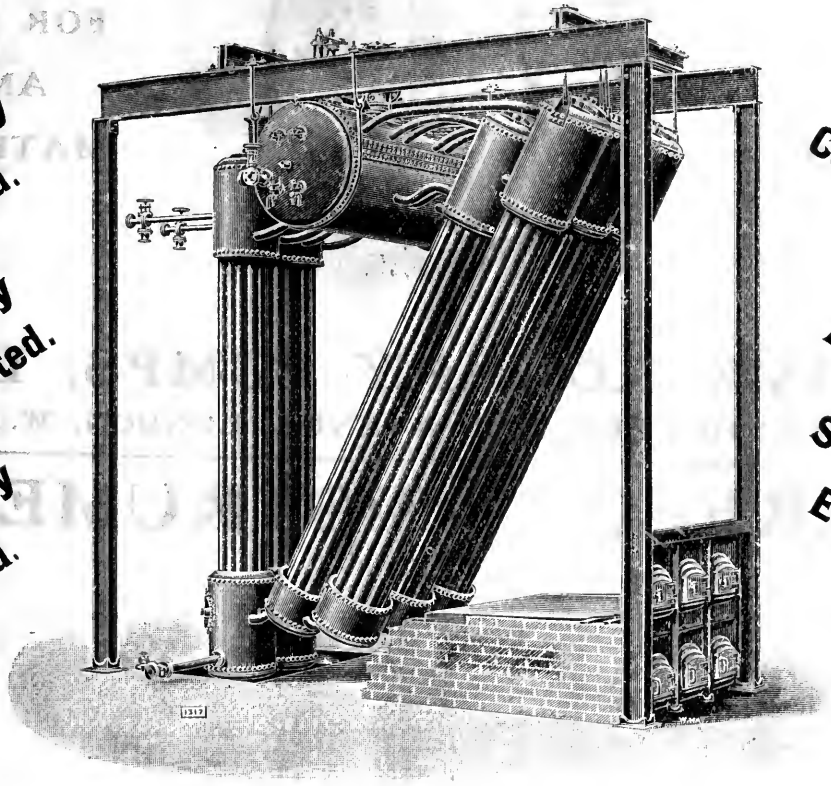

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RICHARDSONS, WESTGARTH, & CO., Ltd.,

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PAGE'S WEEKLY Electrical Apparatus

PAGE'S WEEKLY

Printing

PAGE'S WEEKLY — Railways

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AND
SOUTH EASTERN & CHATHAM RAILWAYS.

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‡ 9.0 p.m. „	Charing Cross Station ...	5.50 a.m.

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†* 9.50 a.m.	For CALAIS only	
†* 11.35 a.m.	... ...	6.45 p.m. Victoria Station
‡ 8.40 p.m.	... Intermediate Stations	5.40 a.m. Charing Cross Station.

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PAGE'S WEEKLY

Miscellaneous

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